AN APPROACH TO ENABLE AND ADVANCE OPEN INNOVATION FOR SMALL AND MEDIUM-SIZED ENTERPRISES

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DECLARATION

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Abstract

Small and medium-sized enterprises form a very important part of any economy. These organisations generally provide 60–70 percent of the employment in countries. The success and growth of SMEs have a direct impact on a country's GDP, but SMEs also face challenges and constraints due to their size. Available resources must be managed and spent wisely.

To be more competitive, SMEs often turn to innovation to develop new products and services that can help them grow and be more relevant in the market. One can argue that innovation has become an imperative for business success. Open innovation practices are becoming more prevalent in organisations as a way to innovate. More organisations are adopting open innovation to gain wider access to knowledge and technology not otherwise available to them internally to the organisation or to appropriate value from their own knowledge and technology. Adopting these new innovation processes however requires a change to organisational and management practices.

Research into open innovation in SMEs has generally lagged behind research in larger organisations. Available research does show that there are benefits to using open innovation by SMEs, but also that current open innovation practices tend to be ad hoc in nature and are usually not managed as a formalised approach. Open innovation is still an evolving field, especially in its application within SMEs. There is a requirement to develop a formalised approach to help SMEs navigate the adoption and use of open innovation within their organisations.

This dissertation follows a design science research method to develop such an approach that SMEs can use for the implementation, execution and improvement of open innovation within their organisations. First, the need for such an approach was established through a review of the literature and a study of South African SMEs. Thereafter, a series of design cycles was undertaken to develop various artefacts to form an integrated open innovation approach.

The approach consists of an open innovation life cycle framework, design propositions with detailed descriptions filling out the framework and a toolset of templates that help users better interact with the content of the approach.

Following the design science research method, a practical solution was sought for a real field problem. It is grounded in the philosophical paradigm of pragmatism and balances the need to develop theory and application.

Opsomming

Klein en mediumgrootte ondernemings vorm 'n baie belangrike deel van enige ekonomie. Hierdie organisasies voorsien gewoonlik 60 tot 70 persent van die indiensneming in lande. Die sukses en groei van KMO's het 'n direkte impak op die BBP van die land, maar die KMO's ondervind ook uitdagings en beperkings as gevolg van hul grootte. Beskikbare bronne moet bestuur en deeglik bestee word.

Om meer mededingend te wees, draai KMO's dikwels na innovasie om nuwe produkte en dienste te ontwikkel wat hulle kan help groei en meer relevant in die mark te maak. Daar kan ge-argumenteer word dat innovasie noodsaaklik geword het vir besigheidsukses. Oop innovasiepraktyke raak meer algemeen in organisasies as 'n manier om te innoveer. Meer organisasies neem oop innovasie aan om wyer toegang tot kennis en tegnologie te verkry wat nie andersins intern beskikbaar is vir die organisasie nie of om meer waarde te verkry uit hul eie interne kennis en tegnologie. Die aanvaarding van hierdie nuwe innovasieprosesse vereis egter 'n verandering in organisatoriese en bestuurspraktyke.

Navorsing oor oop innovasie in KMO's is oor die algemeen agtergelaat teenoor navorsing in groter organisasies. Beskikbare navorsing toon aan dat daar voordele is vir die gebruik van oop innovasie deur KMO's, maar ook dat huidige oop innovasiepraktyke ad hoc van aard is en gewoonlik nie as 'n formele benadering bestuur word nie. Oop innovasie is steeds 'n ontwikkelende veld, veral in die toepassing daarvan in KMO's. Daar is 'n vereiste om 'n formele benadering te ontwikkel om KMO's te help om die aanneming en gebruik van oop innovasie binne hul organisasies te navigeer.

Hierdie proefskrif volg 'n navorsingsmetodologie vir ontwerpwetenskap om so 'n benadering te ontwikkel wat KMO's kan gebruik vir die implementering, uitvoering en verbetering van oop innovasie binne hul organisasies. Eerstens word die behoefte aan so 'n benadering vasgestel deur 'n oorsig van die literatuur en 'n studie onder Suid-Afrikaanse KMO's. Daarna word 'n reeks ontwerpsiklusse onderneem om verskeie artefakte te ontwikkel om 'n geïntegreerde oop innovasiebenadering te vorm.

Die benadering bestaan uit 'n oop innovasie lewensiklus raamwerk, ontwerp proposisies met gedetailleerde beskrywings wat die raamwerk invul en 'n gereedskapstel van werksblaaie wat gebruikers help om beter in wisselwerking met die inhoud van die benadering te tree.

Deur die ontwerpwetenskapnavorsingsmetode word 'n praktiese oplossing gesoek vir 'n werklike veldprobleem. Dit is gegrond op die filosofiese paradigma van pragmatisme en balanseer die behoefte om teorie en toepassing te ontwikkel.

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Chapter 1: Introduction

Over the last decade open innovation has grown in popularity and success to increase innovation effectiveness and speed, especially within larger organisations (Vega et al., 2013). A need, however, exists within the Small and Medium-sized Enterprise (SME) sector to also improve how organisations innovate and to reduce cost and turnaround times for innovation in order to be more competitive (Lee et al., 2010). By utilising best practice open innovation models together with other business management methods and adapting them to the SME sector, similar benefits should be possible to what is being experienced by larger organisations (Terziovski, 2010). Especially in the South African context, this could be vital to provide a competitive advantage and access to global input into the innovation process through collaboration and social innovation.

1.1 Research Domains

This research aims to bring three different domains together, namely, open innovation, SMEs and business management methods.

Within this study, business management methods (BMMs) will refer to frameworks, techniques or models aimed at improving the management and performance of organisations. Examples of BMMs in this context would be, for instance, Business Models, Agile or the Deming improvement cycle.

Business management methods are generally used to add value to the business operations or management of the business in forms such as:

- monitoring and control methods
- cost optimisation methods
- efficiency optimisation methods
- strategy development alignment methods
- business planning and design methods
- project management methods.

In most countries, SMEs make up a large proportion of economic activity and employment and thus play a vital role in the success of the economy. The size of SMEs varies in definition depending on the country that they are in. In the South African context, SMEs are classified as organisations with an employee count of between 1 and 200 (National Small Business Act, 1996). SMEs play a vital role in the economic stability and growth of any country and any benefit that open innovation can provide to such organisations should be exploited. This is even more important for an emerging economy such as South Africa's to ensure competitiveness in a global environment.

Although open innovation is considered a fairly new field of study, more and more papers are being produced showing the application, benefits and challenges of applying this innovation practice within organisations (Gassmann et al., 2010). It is, however, still an evolving focus area and more is needed, not just from a research perspective (van de Vrande et al., 2009), but also from an application perspective, to make it more accessible to SMEs.

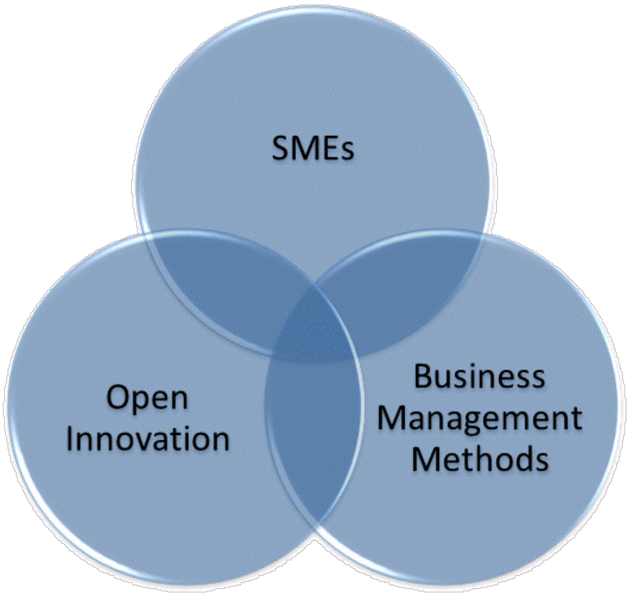


FIGURE 1-1: DOMAINS

This research therefore looks to bring together these three domains to further advance theory and also the practical application of open innovation in SMEs.

1.2 Research Problem

The effectiveness of using open innovation in SMEs is becoming increasingly evident with case studies emerging in literature such as *The Quilts of Denmark* case (Silberzahn and Van Dyck, 2010) where open innovation was successfully applied in the development of new products to penetrate very specific customer segments, leveraging technology external to the organisation within the innovation process. This research study will make use of global applications and theory of open innovation, but also add a South African context and perspective to it.

Open innovation is still an evolving management practice with new application approaches being explored continuously (Chesbrough & Brunswicker, 2013; Krause et al., 2012). Chesbrough and Brunswicker (2013) state that "it is not easy to implement open innovation. Open innovation is a systemic shift that requires rethinking many aspects of one's business to utilise it effectively". Research into open innovation among SMEs is however considered to be lagging behind research in larger organisations and requires attention to understand the phenomenon in the context of SMEs (Bianchi et al., 2010; Chesbrough, 2010).

There is also the opportunity for synergies to be derived when combining open innovation with other business management methods. The relevance of business management methods incorporated within open innovation should be considered to understand the effect of combining these approaches and possible benefits in doing so for SMEs considering the limitations and constraints faced by this segment.

Huizingh (2011) states that "the internal process by which companies manage open innovation is still more trial and error than a professionally managed process. What is missing is a decent cookbook, an integrated framework that helps managers to decide when and how to deploy which open innovation practices".

To achieve an optimal open innovation approach, it is required to establish the specific needs for SMEs for this purpose and then to determine the appropriate framework and methods to support the requirements, given our current knowledge on the subject of open innovation.

The problem considered in this study therefore is that there is a need for a formal approach that SMEs can use to apply Open Innovation within their organisations.

The main research question for this study can therefore be stated as:

- *How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?*

Open innovation is more regularly being adopted by SMEs as a way to innovate (Gassmann et al., 2010; Hossain, 2015). The literature on the effects of open innovation within SMEs is slowly growing, exploring the reasoning and results of using open innovation in these organisations. Understanding the argument for using open innovation helps position the need for developing an approach for open innovation in SMEs, compared to traditional closed innovation.

This leads to the first secondary research question for this study being:

- Why should SMEs consider using open innovation?

Following from the question above and providing further context for the development of the approach, it will be appropriate to understand how open innovation is currently being adopted and used within South African SMEs. Academic research on open innovation utilisation in South African SMEs is very scarce. Before developing an approach for SMEs to use, it is important to understand the current environment. Knowing if and how SMEs use open innovation in their organisations can help shape requirements for the approach, or even dispute the need to develop such an approach. The starting point for this research dissertation is therefore to obtain a clearer view of open innovation within South African SMEs. This then leads to the second associated research question to support the main research question:

- What is the appetite for and use of open innovation in SMEs within South Africa?

According to Chesbrough and Brunswicker [23], “a formal approach implies that firms have a clearly documented strategy for open innovation, use written and standardised processes for implementing open innovation, document their routines, and rely on different kinds of metrics for measuring and reviewing the impact of open innovation”. Developing an open innovation approach would require an understanding of what such an approach should contain, information on what can be considered best practice and input on how such an approach should perform. Developing the open innovation approach is essentially a design problem. To design the approach, it is required to understand the requirements the approach needs to adhere to. To use an analogy, when developing a new carriage for a train, the designer would need the requirements for the carriage. The requirements would specify constraints within which the carriage will have to operate, features required, how the carriage will be used etc. It would make sense to design the framework (including dimensions, outer boundaries, etc.) before designing what can be placed inside the frame. This gives a structured, stepwise method for completing the train carriage design.

Following similar logic, the following three research questions can be developed. First, the design requirements are defined for the approach, then a framework is developed to provide structure to the approach and then lastly, design propositions (explained in more detail in chapter 3) are developed to fill in the framework with details of the approach. The three additional secondary research questions are defined as:

- What are the design requirements for an open innovation approach for SMEs?
- What framework can be developed for an open innovation approach for SMEs?
- What design propositions can we develop for an open innovation approach for SMEs?

By answering the above research questions and addressing the research problem, the main objective of this study is:

- *To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations*

With secondary objectives being:

- To determine the argument for using open innovation in SMEs based on the established literature
- To determine the appetite for and use of open innovation in South African SMEs
- To determine design requirements for an open innovation approach for SMEs
- To develop a framework for an open innovation approach for SMEs
- To develop design propositions for an open innovation approach for SMEs.

1.3 Research Approach

The detailed research methodology is discussed in Chapter 2 of this document, which followed a design science research (DSR) method. The research is grounded in the philosophical paradigm of pragmatism – the generation and application of knowledge through inquiry processes (Goldkuhl 2012). Following the DSR method as proposed by Peffers et al. (2008), the study comprised of the following:

1. Problem Identification and Motivation
    - Initial literature study within the domains of open innovation, and small to medium-sized enterprises.
    - Establishing the appetite for and landscape of open innovation within South African SMEs through a survey.
2. Definition of Solution Requirements
    - Deriving design requirements for an open innovation approach.
3. Design and Development
    - Developing a framework for the open innovation approach.
    - Developing design propositions for an open innovation approach.
    - Developing a practical open innovation approach applicable to the SME market.
4. Demonstration and Evaluation
    - Verification and validation of the approach.
5. Communication
    - Deriving findings and conclusions.

The research followed mostly a qualitative approach, dominated by research synthesis, except for the survey completed regarding South African SMEs which provided an element of quantitative analysis to the study.

1.4 Document Structure

Flowing from the approach discussed above, this research document comprises of 10 chapters:

Problem Identification and Motivation

Chapter 1 – Introduction: positions the research by providing the problem statement and research questions.

Chapter 2 – Research Methodology: a detailed discussion of the methodological approach taken within this research study, providing a motivation for selection design science research. The chapter looks at the theoretical perspectives for research pertaining to a 'design problem' as mentioned earlier in this chapter and the reasoning behind selecting the specific approach towards design science research.

Chapter 3 – Theoretical Background: provides an introduction to the theory related to the research topics as background to the research. It provides the reader with baseline information on the topics that will be explored in more detail and expanded on throughout the subsequent chapters. It also answers the first secondary research question: 'understanding the reasoning and effect of using open innovation within SMEs'.

Chapter 4 – Open innovation in South African SMEs: the second secondary research question is addressed through a survey conducted among South African SMEs to better understand their appetite for and use of open innovation. The results from the survey motivate the need for developing an open innovation approach and also provide requirements for the development of the approach.

Definition of Solution Requirements

Chapter 5 – Design Requirements for an open innovation approach: using insights from chapters 3 and 4 and from additional theory, chapter 5 proposes design requirements for the open innovation approach. The requirements will guide the development of the approach and will also be used to test the final design artefacts to assess if the approach meets these requirements.

Design and Development

Chapter 6 – A Framework for an open innovation approach: the first design iteration within the research method takes place in this chapter where an initial framework is developed for the open innovation approach. It provides boundaries to the approach and a structure which detailed elements of the approach can 'hang on'. The framework is developed through a process of research synthesis, drawing from the theory on topics of innovation and business management methods.

Chapter 7 – Design Propositions for an open innovation approach: performing further research synthesis guided by the open innovation framework from chapter 6, design propositions with detailed descriptions are developed for the approach. The design propositions are statements that users of the approach should consider when applying the approach in their organisations i.e. implementing, executing or improving open innovation. The detailed descriptions underlying the propositions provide richer theoretical grounding to the propositions and also contain references to tools and techniques to use when adopting open innovation.

Chapter 8 – An open innovation approach for SMEs: the end result of the design process is the open innovation approach. The approach combines the artefacts from the iterative design processes into a final deliverable that can be used by SMEs to implement, execute and improve open innovation within their organisations.

Demonstration and Evaluation

Chapter 9 – Verification and Validation: the research methodology requires the final artefact – the open innovation approach – to be validated. A validation process is followed according to the design sciences methodology where the approach is peer and user reviewed, assessed against the design requirements from chapter 5 and discussed by means of an illustrative case study.

Communication

Chapter 10 – Conclusions: concluding the research dissertation, the research process and the resulting artefacts are reflected on in terms of rigour and contribution. A perspective is provided on how the research questions were addressed during the study and also poses topics for future research resulting from this study.

1.5 Chapter Guide

The following visual guide will be used within this document to help the reader with navigation and context, highlighting the current chapter within the document.

The visual guide shows the 10 chapters that will be followed in the document.

Chapter 2: Research Methodology

This chapter will describe the research methodology followed in this dissertation. In chapter 1 the research questions were defined which centred around the design and development of an open innovation approach for SMEs. The research methodology being introduced in this chapter is therefore one that supports design and the development of a practical output.

2.1 Design and Research

The Merriam-Webster online dictionary defines 'design' as

- To plan and make decisions about (something that is being built or created)
- To plan and make (something) for a specific use or purpose.

BusinessDictionary.com defines 'design' as

- Realisation of a concept or idea into a configuration, drawing, model, mould, pattern, plan or specification (on which the actual or commercial production of an item is based) and which helps achieve the item's designated objective(s).

Design takes abstract thought and converts it into something structured and more tangible. An architect, for instance, will design a building before it is built, making blueprint drawings of the house that can be assessed in terms of feasibility (structural soundness etc.) and in terms of usability (form and function). The assessment will usually be performed by two different parties, the structural assessment by a civil engineer and the function by the 'user', the customer who commissioned the building.

Design can be used as both a verb and a noun – the act of designing and the design output. A design is usually made to address a specific problem and to bring about a better situation than that of the problem (Denyer et al., 2008). The design process is by definition iterative, with feedback received from evaluating the design providing input back into the design process (Hevner et al., 2004).

From chapter 1, the research problem was identified as a need for a formal open innovation approach for SMEs. Huizingh (2011) calls for a 'cookbook' or integrated framework and guide for open innovation to be developed for adoption in organisations.

Prescriptive science aims "to provide solutions that improve reality – to benefit mankind" and to achieve "the improvement of the human condition" (Tan, 2010) and follows the philosophical paradigm of pragmatism associated with action, intervention and constructive knowledge (Goldkuhl, 2011). Pragmatism "suggests that the value of anything is determined solely in terms of its usefulness in achieving a certain end" (Barger 2001 in Gous, 2014). "Prescriptive research seeks to inform individuals or organisations what should be done" (Tan, 2010) guiding them with answers to real-world problems.

Prescriptive research can be summarised as per the Table 2-1 below (Van Aken, 2004).

TABLE 2-1: PRESCRIPTIVE KNOWLEDGE

Characteristic	Prescription-driven research
Dominant paradigm	Design sciences
Focus	Solution focused
Perspective	Player
Logic	Intervention-outcome
Typical research question	Alternative solutions for a class of problems
Typical research product	Tested and grounded technological rule
Nature of research product	Heuristic
Justification	Saturated evidence
Type of resulting theory	Management theory

"Design remains an important concern in organisations, and issues of design have much to recommend them as important ways of analysing and understanding organisations. Pursuing a design perspective, broadly defined, would therefore, be useful in advancing organisational analysis" (Pfeffer, 1997). The design approach is very relevant to management research (Tan, 2010). Management research can be considered "a specific dimension of business research, where the research is concerned with influences on the work behaviour of people – how to achieve more efficiency, effectiveness and productivity" and "generate sound information with which to guide management decisions" (Page & Meyer, 2000). Management research can be used for understanding *and* application (Tushman & O'Reilly, 2007) and, coupled with design sciences, to "develop knowledge to design interventions to solve improvement problems and to design systems (coherent structures and processes)" (Tan, 2010). It therefore extends the design process to management research, and into the realms of organisations, processes, systems and people (Tan, 2010).

Since management research is typically people orientated and applied (with a specific application in mind), a qualitative approach is favoured, although quantitative approaches can also be included (Page & Meyer, 2000). Qualitative research, following an interpretivist paradigm, aims to "find new interpretations or underlying meanings and adheres to the ontological assumption of multiple realities, which are time- and context-dependent" (De Villiers, 2005). It tries to identify methods and patterns, explaining social phenomena under investigation (Gous, 2014). It involves the use of case studies, focus groups, participant observation, documents and artefact studies (De Villiers, 2005).

Gous (2014) provides a summary of various qualitative research methods as per the following table, drawing from various sources in the literature.

TABLE 2-2: QUALITATIVE RESEARCH

Research Methods	Description
Appreciative inquiry	• Process of collaborative enquiry that collects and celebrates the good news stories of a team, organisation or community that serve to enhance cultural identity, spirit and vision.
Design science research	• Involves the analysis of the use and performance of designed artefacts to comprehend, explain and improve the behaviour of aspects of information systems.
Action research	• Iterative method for determining a current situation of interest and then designing an intervention (Baskerville & Wood-Harper, 1996). • Researcher collaborates with practitioners and deliberately intervenes. • Contributes to both research and practice (De Villiers, 2005).
Case study	• Explores a single entity or phenomenon bounded by time and activity to establish an understanding of an issue (Olivier, 2004; Yin, 2003). • Collects detailed information using a variety of data collection methods over a sustained period.
Focus group	• Stimulates thinking and creativity through the dynamics of interaction in the context of a small group – similar to a brainstorming session (Olivier, 2004).
Ethnography and participant observation	• Researcher studies an intact group of individuals in a natural setting over a specific period of time. • Observes what people are doing as well as what they say they are doing – i.e. the participant as observer (Olivier, 2004; Hunter, 2004).
Hermeneutics	• Theory of interpretation of meaning, primarily concerned with the meaning of texts or other human artefacts from the point of view of its author (Olivier, 2004).
Systematic review	• Formal and systematic review of literature, developed in order to gather and evaluate the available evidence pertaining to a focused topic (Biolchini et al., 2005).

Of special interest to this study is Design Science Research which will be expanded on in the following section.

2.2 Design Science Research

Design science research makes use of design as a research method, with the goal of producing an artefact that addresses a real-world problem (Hevner et al., 2004; Vaishnavi & Kuechler, 2004). "The mission of a design science is a quest for improving the human condition by developing knowledge to solve field problems, i.e. problematic situations in reality" (Denyer et al., 2008). Design science research has gained popularity in fields such as engineering, medical sciences, law and management. Denyer et al. (2008) refer to the writings of Aristotle which described the differences between knowledge 'for knowledge's sake' and knowledge intended to solve a field problem:

- Praxis, acting upon one's situation to improve one's condition;

- Theoria, explanatory knowledge for its own sake (the scientific ideal);
- Techne, making artefacts.'

Design sciences therefore focus on praxis and techne, seeking solutions to both improvement (for existing entities) and construction problems (to build new), (Denyer et al., 2008), increasing the practical relevance of research (Weber, 2011). "Design Science refers to an explicitly organised, rational and wholly systematic approach to design" (Cross, 2001).

Kuechler & Vaishnavi (2011) state that design science research lends itself to the notion of "learning through building", given the iterative nature of design. This supports research where new interactions between existing entities (or artefacts) are being tested or where new principles or applications are being introduced.

Hevner (2007) provides a three-cycle view of design science research, based on the similar Information Systems research framework (Hevner et al., 2004). The cycles relate to *Relevance, Rigor,* and *Design*. "The Relevance Cycle bridges the contextual environment of the research project with the design science activities. The Rigor Cycle connects the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project. The central Design Cycle iterates between the core activities of building and evaluating the design artefacts and processes of the research" (Hevner, 2007). The three-cycle model therefore results in theory and practice reinforcing one another (de Sitter et al., 1997).

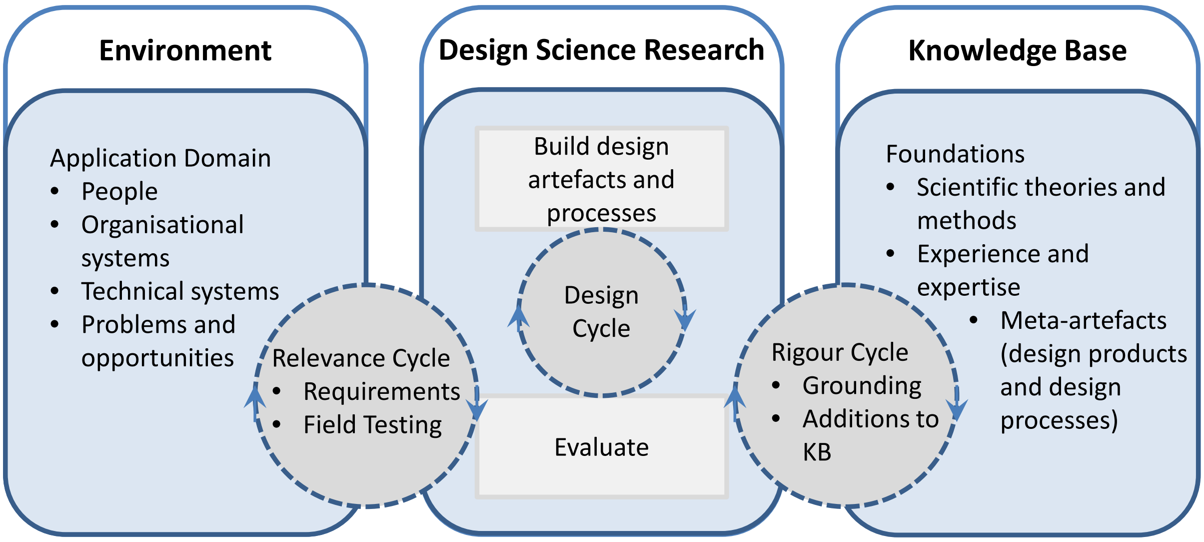


FIGURE 2-1: THREE CYCLE MODEL

It was mentioned that design sciences are preoccupied with finding solutions to real-world (field) problems. Within the three-cycle view, relevance is achieved through addressing a specific and real problem within the application space (Hevner et al., 2004). It provides the application context of the research, together with the research requirements and acceptance criteria for evaluation of the research results. Connecting to management research, the problem is normally defined in the context of an organisation, pertaining to business processes, people, culture, organisational design and strategies.

The Rigour cycle provides a grounding for the research by drawing from the existing knowledge base and utilising available theories, frameworks, methods, processes, expertise and other artefacts relevant to the problem and design space (Hevner et al., 2004; Iivari, 2007). An important aspect within the Rigour cycle is the flow of knowledge from the research back into the knowledge base in the form of extensions or new artefacts (Hevner, 2007).

The Design cycle results in a design artefact through the process of iterative building and evaluation (Hevner, 2007). The design is informed by both the Relevance cycle, providing the problem and requirements and by the Rigour cycle, providing the evaluation criteria and grounded previous knowledge the design will draw from. The number of iterative cycles will depend on how soon the designed artefact can satisfy the problem requirements, or other factors such as time available and costs. (Hevner, 2012; Gous, 2014; Weber, 2011).

Denyer et al. (2008) provide three main characteristics of design sciences:

- Research questions being driven by an interest in field problems;
- An emphasis on the production of prescriptive knowledge, linking it to interventions and systems to produce outcomes, providing the key to solving field problems;
- A justification of research products largely based on pragmatic validity (do the actions based on this knowledge produce the intended outcomes?).

Further characteristics provided by Van Aken (2007) are:

- a focus on establishing the right specifications;
- a strong client orientation;
- a deliberate use of substantive and procedural design science;
- a holistic orientation, meaning that problems have to be analysed, reviewed and tested in their context, i.e. holistically;
- a focus on the desired outcomes.

Hevner et al. (2004) further provide guidelines for design science research as shown in the following table.

TABLE 2-3: DESIGN SCIENCE RESEARCH GUIDELINES

Guideline	Description
Guideline 1: Design as an Artefact	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
Guideline 5: Research Rigour	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact

Guideline	Description
Guideline 6: Design as a Search Process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Design-science research requires the creation of an innovative, purposeful artefact (Guideline 1) for a specified and relevant problem domain (Guideline 2). The artefact must be evaluated for utility (Guideline 3) and provide an improved solution to a known problem (Guideline 4). It must display research rigour by being defined properly, formally represented, coherent, and internally consistent (Guideline 5). The artefact creation process contains a search process whereby a problem space is formed and a mechanism created to find an effective solution (Guideline 6). As a final point, the results of the design-science research must be communicated effectively (Guideline 7) to the appropriate audience (Hevner et al., 2004).

Tan (2010) describes four steps for the design science process.

- Identifying the research problem – this includes defining the problem to be solved and associated design requirements.
- Seek inputs for the design – input for the design solution can be obtained through existing literature or by consulting ‘experts’.
- Developing the design – a process of synthesis and evaluation is followed, abstracting key principles and ideas from the available information.
- Design justification and validation – meeting the needs of the problem identified and of the design specifications, together with providing an assessment of feasibility.

Design science research is focused on developing actionable knowledge that is grounded in evidence (Bate, 2007), but various perspectives exist to achieve this goal (Holloway et al., 2015).

The regulative and reflective cycle from Van Aken et al. (2007) drew on both instrumental and descriptive knowledge (Holloway et al., 2015). The regulative cycle provided a structured way of systematic intervention planning and design (Holloway et al., 2015) with the reflective cycle assisting with learning through doing (Van Aken et al., 2007).

A second perspective used within design science research is that of C-K theory (Hatchuel & Weil, 2009). Drawing from concept (unconfirmed ideas and presumptions) and knowledge (valid and confirmed knowledge) spaces, C-K theory derives solutions through interplay between raw concepts, discovery and deduction (Holloway et al., 2015).

A third perspective provided is research synthesis (Pawson, 2006; Van Aken, 2007; Denyer et al., 2008; Weber, 2011). Pawson (2006) followed a realist synthesis approach, utilising intervention-outcome logic within various contexts. Denyer et al. (2008) expanded on this concept, introducing CIMO-logic. “This logic involves a combination of a problematic Context, for which the design proposition suggests a certain Intervention type, to produce, through specified generative Mechanisms, the intended Outcome(s)” (Denyer et al., 2008).

2.3 Design Propositions Using CIMO-Logic

Van Aken (2005) used the concept of technological rule adapted from Bunge (1967) and defined it as "a chunk of general knowledge linking an intervention or artefact with an expected outcome or performance in a certain field of application". The technological rule followed the sequence of – if you are in situation A and want to achieve outcome B, then perform action C, with the focus on C which will form the solution concept (Van Aken, 2005).

Building on the notion of design propositions from Romme (2003) and incorporating technological rule theory, Denyer et al. (2008) introduced the concept of CIMO-logic driven design propositions for use in design science research. "A design proposition can be seen as offering a general template for the creation of solutions for a particular class of field problems" (Denyer et al., 2008). The logic is constructed, as mentioned before, by considering a specific **C**ontext, applying a certain **I**ntervention, through a **M**echanism, to produce an intended **O**utcome. Denyer et al. (2008) provide an example of what a design proposition using CIMO-logic might look like:

'If you have a project assignment for a geographically distributed team (class of contexts), use a face-to-face kick-off meeting (intervention type) to create an effective team (intended outcome) through the creation of collective task insight and commitment (generative mechanisms).'

Design propositions using CIMO-logic would normally not be stand-alone artefacts, but would contain further information expanding on the proposition or providing deeper insight on how the design proposition was derived. It should aid in a comprehensive learning process and might take on the form of reports, articles, manuals or templates (Denyer et al., 2008). The CIMO-logic is further clarified in the next table, using definitions from Denyer et al. (2008).

TABLE 2-4: CIMO-LOGIC

Component	**Explanation**
Context (C)	The surrounding (external and internal environment) factors and the nature of the human actors that influence behavioural change. They include features such as age, experience, competency, organisational politics and power, the nature of the technical system, organisational stability, uncertainty and system interdependencies. Interventions are always embedded in a social system and, as noted by Pawson and Tilley (1997), will be affected by at least four contextual layers: the individual, the interpersonal relationships, institutional setting and the wider infrastructural system.
Interventions (I)	The interventions managers have at their disposal to influence behaviour. For example, leadership style, planning and control systems, training, and performance management. It is important to note that it is necessary to examine not just the nature of the intervention but also how it is implemented. Furthermore, interventions carry with them hypotheses, which may or may not be shared. For example, 'financial incentives will lead to higher worker motivation'.
Mechanisms (M)	The mechanism that is triggered in a certain context by the intervention. For instance, empowerment offers employees the means to contribute to some activity beyond their normal tasks or outside their normal sphere of interest, which then prompts participation and responsibility,

Component	Explanation
	offering the potential of long-term benefits to them and/or to their organisation.
Outcome (O)	The outcome of the intervention in its various aspects, such as performance improvement, cost reduction or low error rates.

Following the design proposition method with CIMO-logic provides a solution concept that is underscored by the literature and theory, although the theory is not the focus. “The focus is on a design that is capable of working” (Tan, 2010).

Grounding of the design proposition is achieved using the generative mechanisms in the CIMO-logic (Van Aken, 2005; Pawson & Tilley, 1997) drawing from insights in literature and theory. “Mechanisms consist of component parts and their activities/interactions. They produce something” (Weber, 2011). Mechanisms are characteristics operating in organisational processes, but can also take the form of strategies and related activities, and tactics or instruments (Weber, 2011; Tan, 2010).

Furthermore, CIMO-logic serves to provide structure for the research synthesis process to determine design propositions from literature. Although seemingly restrictive from a design perspective, (design) decisions are still performed in the pattern recognition and inclusion of information from the literature to form the design propositions within the CIMO-logic format.

2.4 Abstraction and Synthesis

Booth et al. (2012) defined literature review as “identifying, evaluating and synthesising the existing body of completed and recorded work produced by researchers, scholars and practitioners”. Developing design propositions requires the process of abstracting from prior literature and synthesising into a solution concept (Tan, 2010). It is moving from the detailed literature and firstly, as part of the problem and requirement definition stage, following an inductive approach, and then as part of the design process, following a deductive approach (Elo & Kyngäs 2007; Vaishnavi & Kuechler 2004). Deduction is performed through interpretation and contextualisation based on the research question (Peters, 2014).

“Abstraction is the mental operation of picking out certain qualities and relations from the facts of experience. Abstraction comes through the perception of similarities between individual facts, and all language and all thinking depend upon it” (Williams, 1973). Design propositions are often constructed at a higher level of abstraction than the original material on which it is based, providing a more generic principle-based proposition (Tan, 2010, Strauss 1998). “Concepts are developed through constant comparison, interpretation, and abstraction” (Peters, 2014).

Within design science research, Vaishnavi & Kuechler (2004) provided a view of the logical formulism in their five-step design science research process.

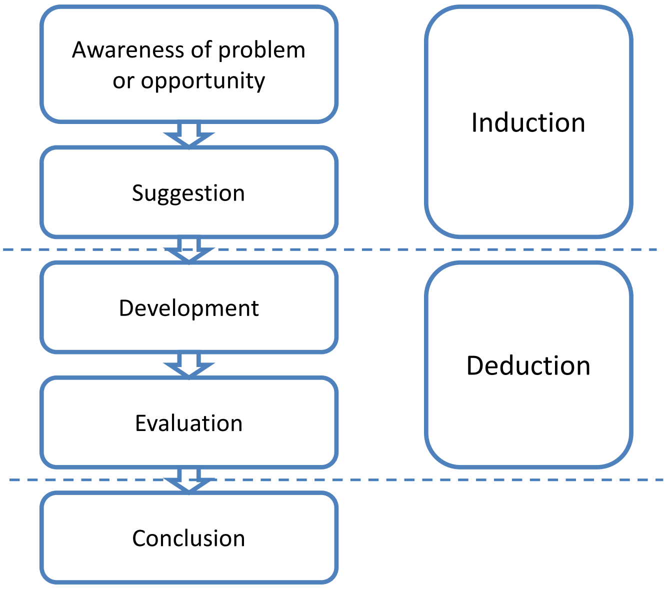


FIGURE 2-2: FIVE-STEP PROCESS FROM VAISHNAVI & KUECHLER

Gous (2014) provided a summary of the steps from the model:

Awareness of the problem: The awareness of the problem emanates from multiple sources through the Relevance cycle and includes new developments in industry or academia. In this step the problem is identified and defined and the output is a formal or informal proposal for a new research effort.

Suggestion: This phase is closely linked to the awareness phase and is essentially a creative phase in which an artefact which may be a solution to the problem is suggested. This suggestion can be inductively drawn from existing knowledge or theory or by using an appropriate research methodology.

Development: The tentative design from the suggestion phase is implemented in this phase and the artefact is produced. During artefact production, the tentative design may still be further refined and several iterations may be required.

Evaluation: Once an implementation of the artefact is ready, it is evaluated accordingly to determine the degree to which it satisfies its requirements and to explain deviations from these. Evaluation can include methods such as action research, controlled experiments, simulation and scenarios. The evaluation results, as well as lessons learnt in the development process, may lead to iteration of the Design Cycle. These cycles of suggestion, development and evaluation continue until the artefact is assessed as sufficient.

Conclusion: This is the final phase of the Design Cycle and signifies the production of an artefact, the behaviour of which was judged as adequate in the evaluation phase, although not necessarily optimal. In the conclusion phase, researchers document the artefact as well as lessons learnt that may lead to potential further research, for contribution to the body of knowledge and the Design Cycle concludes.

The process of abstraction through induction and synthesis through deduction are common to research methods such as grounded theory method (GTM), qualitative content analysis and qualitative systematic review (Peters, 2014; Elo & Kyngäs, 2007; Booth et al., 2012).

"A qualitative systematic review integrates and compares findings from qualitative studies, with the objective of finding themes or constructs in or across individual studies" Gous (2014). Khan et al. (2003) outlined five steps to follow for systemic review.

- Framing questions for a review
- Identifying relevant work
- Assessing the quality of studies
- Summarising the evidence
- Interpreting the findings

Grounded theory uses the researcher's ideas and previous knowledge to build a heuristic framework that guides the analysis (Peters, 2014). The grounded theory method can be used selectively throughout the research process without prescribing precise procedural steps (Von Oertzen, 2006). The following guidelines were, however, suggested by Mey & Mruck (2009) when using grounded theory method:

- Develop concepts through continued comparison, interpretation, and abstraction of data segments, leading to the building blocks for a grounded theory.
- Data collection and analysis should be iterative, providing theoretical saturation - the gradual development of concepts based on the purposeful and selective collection of those data that contribute to the analysis (Peters, 2014).
- Documentation of the decisions regarding case selection, sampling, and analysis.

The qualitative content analysis model by Elo & Kyngäs (2007) provided three main steps to follow for qualitative induction and deduction.

- Preparation phase – making sense of the data and completely immersing oneself in the material
- Organising phase – abstraction and/or deduction of content into meaningful categories
- Reporting phase – providing the results in the form of a model or conceptual system

2.5 Evaluation

Key to design science research is how the design output is evaluated (Venable et al., 2012; Denyer et al., 2008). Hevner et al. (2004) prescribed that "the utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods". The purpose of evaluation is to "evaluate an instantiation of a designed artefact to establish its utility and efficacy (or lack thereof) for achieving its stated purpose" (Venable et al., 2012). Further reasons for evaluation sited by Venable et al. (2014) were the substantiation of design theory in terms of the quality of the knowledge outcomes (Baskerville et al., 2007) to provide evidence that the theory led to some developed artefact that would be useful for solving a problem or making an improvement, or to establish whether the new artefact added to or improved the state of the art.

Offermann et al. (2009) suggested using methods such as case studies, expert surveys or laboratory experiments to perform design science evaluations. Van Aken (2005) stated that design science artefacts must be field tested, testing it in its intended field of application. He recommended using case studies to achieve this goal.

"In developing and testing a design proposition through the multiple case and in analysing its effectiveness through the cross-case analysis during the reflective cycle, one can gain insight in the indications and contra-indications for the application of that design proposition and hence also in its application-domain" (Weber, 2011).

Some further methods suggested by Venable et al. 2012 were focus groups, mathematical or logical proof, illustrative scenarios, ethnography and computer simulation. Deciding on a method can be guided by the use of a selection matrix based on the type of evaluation characteristics required (Venable et al., 2012). Distinctions are made between *naturalistic* and *artificial* evaluation and between *ex ante* and *ex post* evaluation as contextual factors. This led to the following evaluation method selection framework by Venable et al. (2012).

	Ex ante	Ex post
Naturalistic	• Action research • Focus group	• Action research • Case study • Illustrative scenario • Focus group • Participant observation • Ethnography • Phenomenology • Survey (qualitative or quantitative)
Artificial	• Mathematical or logical proof • Laboratory experiment • Computer simulation • Criteria-based evaluation	• Mathematical or logical proof • Laboratory experiment • Role playing simulation • Computer simulation • Field experiment

FIGURE 2-3: EVALUATION METHOD SELECTION FRAMEWORK

Deciding which method to use, however, is dependent on the context in which the evaluation needs to be performed (Gous, 2014) in terms of:

- the different purposes of evaluation
- the characteristics of the output to be evaluated
- the type of output to be evaluated
- the specific goals that must be balanced.

Deciding on the appropriate strategy can be guided on the basis of the design science evaluation strategy selection framework (Figure 2-4) also by Venable et al. (2012). Based on the evaluation goals and the research context and constraints, the researcher can select the most appropriate strategy quadrant for implementation. If there are conflicting goals, then more than one quadrant can be selected for a hybrid strategy, trying to satisfy priority goals (Venable et al., 2012).

Illustrative scenarios are defined by Peffers et al. (2012) as the "application of an artefact to a synthetic or real-world situation aimed at illustrating suitability or utility of the artefact" versus a case study which is defined as the "application of an artefact to a real-world situation, evaluating its effect on the real-world situation". Both evaluation methods pertain to the previously mentioned Relevance cycle from Hevner et al. (2004), but with different focus areas in the form of utility versus effect. To execute the interventions in totality to reach the effect of the intervention may however take a long period of time. This may make case studies not viable as an evaluation method in certain instances (Weber, 2011).

Illustrative scenarios may then prove to be a better option, especially where interaction with humans is required to evaluate utility (Venable et al., 2012). Illustrative scenarios also do not necessitate the implementation of the artefact, reducing the risk associated to the organisation performing the evaluation (Venable et al., 2012). Yet another alternative is to have the artefact validated by experts (Tan, 2010), providing an assessment of feasibility (Weber, 2011) and eliminating any potential risk which may occur if the artefact was implemented in a real-world situation.

		Ex ante	Ex post
		• Formative • Lower build cost • Faster • Evaluate design, partial • prototype of full prototype • Less risk to participants (during evaluation) • Higher risk of false positive	• Summative • Higher build cost • Slower • Evaluate instantiation • Higher risk to participants (during evaluation) • Lower risk of false positive
Naturalistic	• Many diverse stakeholders • Substantial conflict • Socio-technical artefacts • Higher cost • Longer time (slower) • Organisational access needed • Artefact effectiveness evaluation • Desired rigor: “proof of the pudding” • Higher risk to participants • Lower risk of false positive (safety critical systems)	• Real users, real problem, • and somewhat unreal system • Low to medium cost • Medium speed • Low risk to participants • Higher risk of false positive	• Real users, real problem, and real system • Highest cost • Highest risk to participants • Best evaluation of effectiveness • Identification of side effects • Lowest risk of false positive • (safety critical systems)
Artificial	• Few similar stakeholders • Little or no conflict • Purely technical artefacts • Lower cost • Less time (faster) • Desired rigor: control of variables • Artefact efficacy evaluation • Less risk during evaluation • Higher risk of false positive	• Unreal users, problem and/or system • Lowest cost • Fastest • Highest risk of false positive regarding effectiveness	• Real system, unreal problem and possibly unreal users • Medium to high cost • Medium speed • Low to medium risk to participants

FIGURE 2-4: DESIGN SCIENCE EVALUATION STRATEGY SELECTION FRAMEWORK

2.6 Research Design

The following section describes the methodology and research strategy chosen for this study. It details the thinking and selection process followed, guided by the methodology discussion in the first part of this chapter.

2.6.1 Main Research Question

In chapter 1 the problem statement that led to this study was discussed and the main research question and objective were defined as:

Question: How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?

Objective: To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.

For reference and traceability, we will codify them as follows:

TABLE 2-5: RESEARCH QUESTION CODING

Ref	Research Question	Ref	Research Objective
MRQ	How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?	MRO	To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations

2.6.2 Research Paradigm

This research follows the philosophy of pragmatism, but also contains strong elements of the interpretivist paradigm. Both philosophies contain elements supporting the design science research method. Pragmatism, however, provides a more complete overall foundation to DSR. Pragmatism is associated with action, intervention and constructive knowledge (Goldkuhl, 2011), creating artefacts to solve real-world problems (Simon 1996).

Pragmatism assumes a symbolic approach to realism and that actions can change reality (Gous, 2014). Design science research is focused on developing actionable knowledge that is grounded in evidence (Bate, 2007), "improving the human condition by developing knowledge to solve field problems, i.e. problematic situations in reality" (Denyer et al., 2008). This research aims to develop an open innovation approach for SMEs, which will allow them to improve their innovation capability.

Pragmatism generates constructive knowledge, which is achieved by design science research through the iterative and progressive design cycles and through synthesis by "comparison, interpretation, and abstraction" (Peters, 2014).

Value is determined in pragmatism by assessing usefulness and testing it in practice (Gous, 2014). Design science research requires the evaluation of an artefact "to establish its utility and efficacy (or lack thereof) for achieving its stated purpose" (Venable et al., 2012).

2.6.3 Research Design Application

Since management research is typically people-orientated and applied (with a specific application in mind), a qualitative approach is favoured (Page & Meyer, 2000). "The mission of a design science is a quest for improving the human condition by developing knowledge to solve field problems", (Denyer et al., 2008), with design science research gaining popularity in fields such as engineering, and specifically industrial engineering (Tan, 2010; Weber 2011). "Design Science Research in management aims both to develop knowledge to design interventions to solve improvement problems and to design systems (coherent structures and processes) to solve construction problems" (Denyer et al., 2008) [7]. It follows the "process of abstracting: generalising from the inputs from the prior research work" (Tan, 2010). This research therefore follows a qualitative research approach with design science research as the chosen method.

"The DSR method involves a rigorous process to design artefacts in order to solve observed problems, make research contributions, evaluate designs and communicate the results to appropriate audiences" (Gous, 2014). Artefacts may include constructs, models, methods and instantiations (Peffers et al., 2008). Design science research is thus a well-suited method to achieve the main research objective of developing an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.

This thesis follows the design science research method proposed by Peffers et al. (2008). The research design is based on five steps:

1. Problem Identification and Motivation
2. Definition of Solution Requirements
3. Design and Development
4. Demonstration and Evaluation
5. Communication

The dissertation structure using the five-step process can be summarised as per Figure 2-5 and is further described as per below.

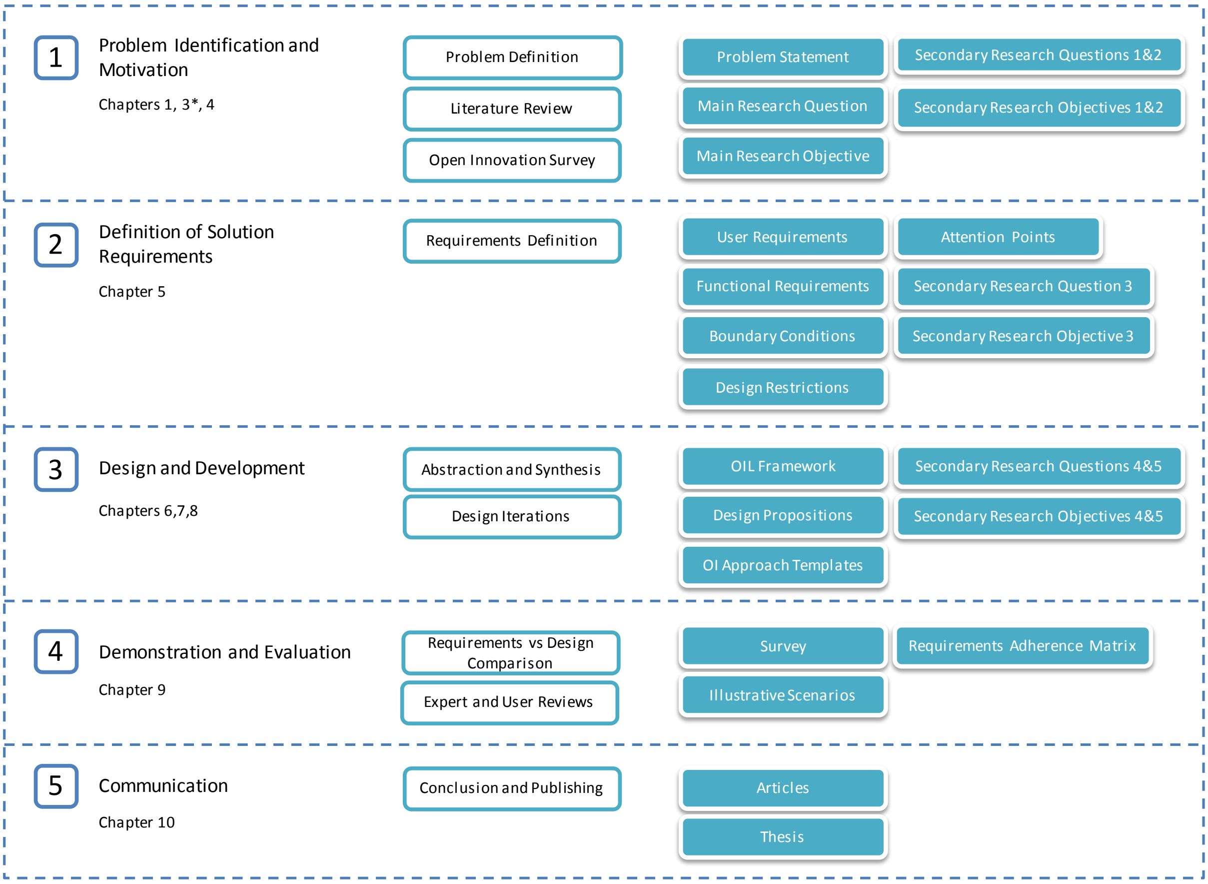


FIGURE 2-5: FIVE-STEP DESIGN SCIENCES METHOD DISSERTATION STRUCTURE

*The methodology is discussed in Chapter 2

2.6.3.1 Step 1: Problem Identification and Motivation

Starting off the research, the research problem is defined stating that no formal approach that includes business management methods exists for SMEs to apply open innovation within their organisations. This leads to the main research question and objective:

MRQ: How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?

MRO: To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.

An initial literature study within the domains of open innovation, business management methods, and small to medium-sized enterprises was performed to further inform the research and serve as a basis for the rest of the research steps. The literature study also helped address the first secondary research question and objective:

SRQ1: Why should SMEs consider using open innovation?

SRO1: To determine the argument for using open innovation in SMEs within the established literature.

To confirm the relevance of the research problem and need for a solution (Tan, 2010), an exploratory survey was conducted among South African SMEs to better understand the appetite for open innovation and how open innovation practices are used by them. For the survey study, the following secondary research question and objective were defined:

SRQ2: What is the appetite for and use of open innovation in SMEs within South Africa?

SRO2: To determine the appetite for and use of open innovation in South African SMEs.

The survey helped confirm that there is a need for a structured approach to implement and execute open innovation within SMEs, confirming the value of pursuing the main research objective.

2.6.3.2 Step 2: Definition of Solution Requirements

During step 2, the requirements for the open innovation approach were defined. The requirements helped to guide the development of the approach and were derived from the prior literature and from the survey which was conducted in step 1.

The secondary research question and objective used during this step are:

SRQ3: What are the design requirements for an open innovation approach for SMEs?

SRO3: To determine design requirements for an open innovation approach for SMEs.

For the design requirements, five different categories were considered:

- User requirements
- Functional requirements
- Design restrictions
- Attention points
- Boundary conditions

A total of 25 design requirements were defined and used as criteria for the requirements adherence matrix used in step 4 during demonstration and evaluation.

2.6.3.3 Step 3: Design and Develop

In this step the open innovation approach was created. The solution artefact is a culmination of three different design iterations.

In the first design iteration, a framework was developed to serve as boundaries to the open innovation approach. It was the first step in the constructivist approach towards developing the open innovation approach design artefact. The development of the framework was driven by the following secondary question and objective:

SRQ4: What framework can be developed for an open innovation approach for SMEs?

SRO4: To develop a framework for an open innovation approach for SMEs.

The framework was derived through a process of abstraction and synthesis from models and frameworks in the literature and comprised of four main components, six subcomponents and twenty-three core elements.

The second design iteration was used to develop the design propositions for the open innovation approach. The design propositions were developed using CIMO-logic and followed the framework developed in the previous design iteration. The design process also followed the process of abstraction and synthesis, consulting existing literature. This included peer-reviewed and grey literature. This was done to overcome the barrier of open innovation in SMEs being such a young field of study. Literature was selected based on the criterion 'fit for purpose' as per Boaz and Ashby (2003) decided on the basis of whether the literature retrieved added anything new to understanding the phenomenon (Denyer et al., 2008; Tan, 2010). Reviews were targeted based on the framework elements and assessed whether the literature in question provided any valuable insight that could be incorporated into the design propositions.

The design iteration was guided by the following secondary research question and objective:

SRQ5: What design propositions can we develop for an open innovation approach for SMEs?

SRO5: To develop design propositions for an open innovation approach for SMEs

The last iteration within step 3 was the development of open innovation approach templates. One of the design requirements developed in step 2 stated that:

The approach should be user-friendly – i.e., easy to adopt, understandable, and easy to use.

To make the open innovation approach more accessible, it was therefore decided that templates would be developed to facilitate ease of use. The templates are user-orientated – intended for use by the SMEs who will implement the open innovation approach, but who are looking for a summarised view of the approach that can facilitate adoption. A total of eighteen templates were developed to guide the user through the design propositions and associated interventions and mechanisms.

The combination of the framework, design propositions and approach templates resulted in the overall solution artefact – the open innovation approach for SMEs.

2.6.3.4 Step 4: Demonstration and Evaluation

The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods (Hevner et al., 2004). First, the solution was compared against the design requirements set out in step 2, to determine if all the design requirements had been considered in the design. This was done by drawing up a requirements adherence matrix.

Secondly, the open innovation approach was peer-reviewed by experts (academics and practitioners) and by potential users (SMEs). This was done through the use of a survey that was sent out, using a Likert scale and commentary space to receive feedback. Questions were aligned to the design requirements as well as general questions to assess usefulness and completeness.

Lastly, illustrative scenarios were used. A full illustrative scenario is provided as a reflective review and a partial scenario is provided based on an SME study.

2.6.3.5 Step 5: Communication

The last step in the design science research method followed in this study required the documentation of the research contribution, lessons learnt and conclusions, together with the effective communication of the study to the appropriate audiences (Peffers et al., 2008; Hevner et al., 2004). Research conclusions are discussed in relation to the research method and then to the research problem and questions. The main research contributions are presented, together with topics for future work.

Communication of the study was done throughout the research process and concluded with the publishing of the thesis. Various papers were presented and published in conference proceedings and two articles were published in an academic journal, focusing on various aspects of the study.

The following table provides a summary of the literature produced and the associated chapters it pertains to within this dissertation:

TABLE 2-6: PUBLISHED LITERATURE

Paper Name	Published Space	Focus Area	Authors
Open Innovation in South African Small and Medium-sized Enterprises	CIE42 Conference Proceedings, 2012, Cape Town, South Africa	Open Innovation Survey results (Chapter 4)	W. Krause, C. Schutte, N. Du Preez
An Exploratory Study on Preferred Open Innovation Types and Partners in South African SMEs	Proceedings of the 2012 IEEE IEEM, Hong Kong	Open Innovation Survey – preferred OI types and OI partners (Chapter 4)	W. Krause, C. Schutte, N. Du Preez
A Perspective on Open Innovation in Small and Medium-Sized Enterprises in South Africa, and Design Requirements for an Open Innovation Approach	South African Journal of Industrial Engineering May 2015 Vol 26(1), pp 163-178	OI Survey overview and definition of the design requirements for an OI approach (Chapters 4 & 5)	W. Krause & C. Schutte
A Framework Towards an Open Innovation Approach for SMEs	IAMOT 2015 Conference Proceedings, Cape Town, South Africa	Open Innovation Lifecycle Framework (Chapter 6)	W. Krause & C. Schutte
Developing Design Propositions for an Open Innovation Approach for SMEs	South African Journal of Industrial Engineering November 2016 Vol 27(3) Special Edition, pp 37-49	Design propositions and open innovation templates (Chapters 7 & 8)	W. Krause & C. Schutte

2.7 Chapter Conclusion

This chapter explored design within a research context and discussed design sciences research as the chosen research method for this study. Different research approaches were considered, resulting in the selection of the appropriate research approach to be followed during this study.

The main research objective of this study was defined as *to develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.* Prescriptive research in the paradigm of pragmatism is therefore fitting, since prescriptive research aims to provide solutions for the improvement of real-world field problems, informing users of the solution on what should be done. Pragmatism supports constructive knowledge and determines value through the achievement of an intended goal.

Creating the open innovation approach is effectively a design problem. Design sciences research follows a design process and results in an actionable result, addressing a real-world problem. It was decided to make use of research synthesis within the design sciences process to 'ground it in evidence' (Bate, 2007).

The concept of CIMO-logic provides a structured way for design propositions to be stated and is selected as an appropriate method for use within the design sciences research method that will be applied. CIMO-logic becomes a template for the design propositions resulting in solution descriptions as an artefact of the design process through research synthesis.

Design takes place to develop the approach in three main areas – the development of the framework in chapter 6, the development of the design propositions in chapter 7 and the development of the templates in chapter 8. The creative process during these design processes varies from more constrained boundaries during the proposition development (given the structure of the CIMO-logic), to more free-flow design in the creation of the templates, which becomes an aggregation of the prior design artefacts.

The research design was based on five steps with the dissertation comprising of 10 chapters. The five steps used to address the research questions following the design sciences research method are:

1. Problem Identification and Motivation
2. Definition of Solution Requirements
3. Design and Development
4. Demonstration and Evaluation
5. Communication.

Chapter 3: Theoretical Background and Literature Review

This chapter introduces the concept of open innovation from an SME perspective, discussing the importance and uniqueness of open innovation in this context. The theoretical background provides further motivation for the research study by expanding on the problem statement provided in chapter 1. It serves to highlight the importance of innovation for SMEs, supporting the need for this study.

The first secondary research question will also be addressed in this chapter being:

Why should SMEs consider using open innovation?

This was done through the literature review to understand the argument for SMEs to consider the use of open innovation to innovate. The literature study helped to explore the reasoning and results of using open innovation within SMEs, further supporting the requirement for an open innovation approach.

Review and synthesis of literature was used throughout the dissertation in the design chapters to develop the open innovation approach. The literature review done in this chapter therefore only forms the initial base to position the background of the study and answer the first secondary research question. More in-depth reviews are in subsequent chapters as they relate to the specific chapter focus areas.

3.1 Innovation

There are many definitions available describing innovation. Joseph Schumpeter provided some definitions as early as 1943 from an economic perspective (Wright 2007:14) such as:

- The introduction of a new good;
- The introduction of a new method of production;
- The opening of a new market;
- The conquest of a new source of supply of materials;
- The carrying out of the new organisation of any industry.

Other definitions include:

- The process of improving an existing product or service (Wikipedia, 2011)
- The process that translates knowledge into economic growth and social well-being. It encompasses a series of scientific, technological, organisational, financial and commercial activities (ARC, 2011)
- Exploiting new ideas leading to the creation of a new product, process or service (Shukla, 2009)
- Creating value out of new ideas, new products, new services or new ways of doing things (Wright 2007:16)
- The successful generation, development and implementation of new and novel ideas (Katz, 2006)

A search conducted on the internet search engine Google for the word 'innovation' in March 2011 provided a search result of about 222 000 000. In February 2017, this number jumped to a staggering 573 000 000. This shows the excitement surrounding innovation and the considered importance of the practice. Drucker (1985) described innovation as an enabler of organisational competitive advantage, making it essential not just to excel, but even to survive in the market place. “Empirical studies demonstrate that innovative firms tend to have higher rates of profits, greater market value, better credit ratings and stronger chances of surviving in the market” (Foss et. al. 2005). Enkel and Gassmann (2010) argued that “enriching the company’s own knowledge base by integrating suppliers, customers, and external knowledge sources can increase a company’s innovativeness”.

Organisations need to innovate to stay relevant. Failure to innovate or adapt to new innovations in the market can lead to the demise of an organisation. Innovation can be in the form of various types, such as “products, services, processes, strategy, business models, marketing and value” (Gous 2014).

Within the domain of innovation, we can distinguish between closed and open innovation. Closed innovation is internally focused with control residing within the organisation (Chesbrough, 2006). The full process of innovation is managed and performed by the organisation, from coming up with new ideas, through to developing those ideas and taking them to market. Within the closed innovation paradigm, the organisation is limited to the knowledge and capabilities contained within the organisation.

Open innovation, in contrast, includes externally focused elements within its innovation model. Lindegaard (2010) describes open innovation as “a two-way process in which companies have an inbound process in which they bring in ideas, technologies, or other resources needed to develop their own business and an outbound process in which they out-license or sell their own ideas, technologies, and other resources. This should take place during all stages of the innovation process”. Open innovation does not rely solely on the organisation’s internal knowledge and capabilities, but aims to leverage the external environment to enhance its own innovation or to benefit from its own innovation in alternative ways. The graphs below illustrate the differences between the two models.

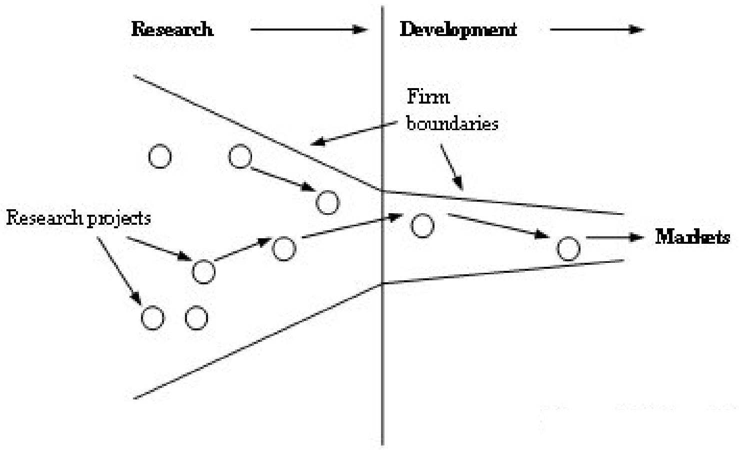


FIGURE 3-1: CLOSED INNOVATION MODEL (SOURCE: CHESBROUGH, 2003)

The closed model shows how ideas are controlled within the strict boundaries of the organisation compared to the more permeable boundaries and interchanging flow of knowledge within the open innovation model.

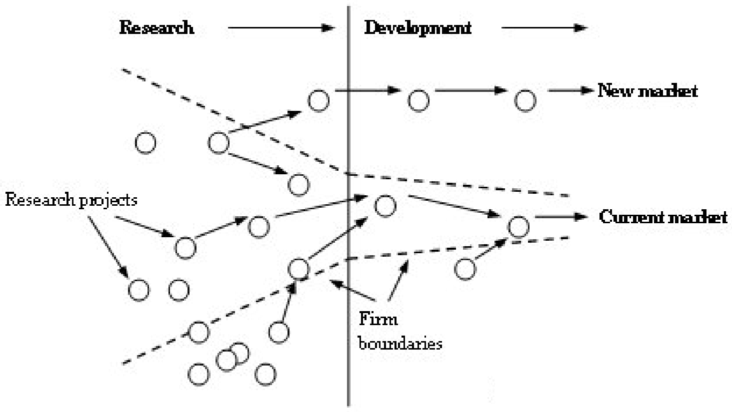


FIGURE 3-2: OPEN INNOVATION MODEL (SOURCE: CHESBROUGH, 2003)

Chesbrough (2003) suggested that "not all good ideas are developed within the own company, and not all ideas should necessarily be further developed within the own firm's boundaries" (www.openinnovation.eu, 2011). Organisations are limited by their own skills and capabilities. Opening up the innovation process allows organisations to access further skills, capabilities and capacity. Table 3-1 further illustrates this:

TABLE 3-1: CLOSED AND OPEN INNOVATION PRINCIPLES (SOURCE: WWW.OPENINNOVATION.EU, 2011)

Closed innovation principles	Open innovation principles
The smart people in the field work for us.	Not all the smart people in the field work for us. We need to work with smart people inside and outside the company.
To profit from R&D, we must discover it, develop it, and ship it ourselves.	External R&D can create significant value although internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to the market first.	We don't have to originate the research to profit from it.
The company that gets an innovation to the market first will win.	Building a better business model is better than getting to the market first.
If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our IP, so that our competitors don't profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our business model.

Open innovation is fast emerging as an important focus area within the innovation domain (www.openinnovation.eu, 2011). Although an internet search for *open innovation* compared to *innovation* will only provide 0.59 percent as many results (3 390 000 results displayed when searched on Google in February 2017)[1], it is becoming an important innovation topic with companies such as Procter & Gamble, IBM, and Google taking the lead in advocating the importance and success of open innovation (http://theopen100.wikispaces.com/, 2011).

Gassmans and Enkel (2004) identified three core open innovation processes as described by Wang et. al. (2009). These are:

- Outside-In: aims to increase the company's innovativeness by enriching the company's own knowledge base through the integration of suppliers, customers, and other external knowledge sources.
- Inside-Out: focus on externalising the company's knowledge and innovations. Companies that choose the inside-out process generate profits by bringing ideas to market, selling IP and multiplying technology by transferring ideas to the outside environment.
- Coupled: combining outside-in with inside-out processes. Companies cooperate with other companies in strategic networks, joint ventures and alliances.

The graph below from Open Innovation.EU (www.openinnovation.eu, 2012) provides a view of this expanded open innovation approach, demonstrating the different processes or paths open innovation can take.

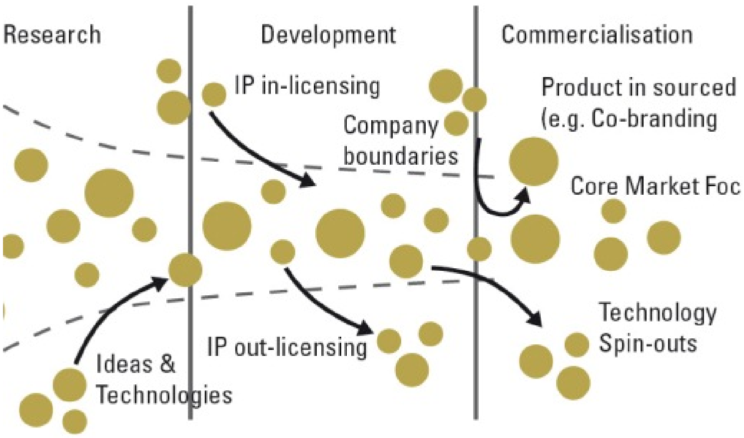


FIGURE 3-3: OPEN INNOVATION PROCESSES

Although a distinction is made between open and closed innovation as two separate concepts, it should be noted that the practical reality of open innovation is generally a state which lies between *fully open* and *fully closed*. Organisations will move from a state of closed innovation to a state of open innovation over time, while still retaining closed innovation aspects. There will always remain parts of the innovation process which will be *closed* to the external environment of the organisation through patents, internal know-how, and other proprietary knowledge. This is normally a strategic decision to provide a form of competitive advantage over competitors. *Open* should therefore be understood as an organisation which applies open innovation concepts, together with closed innovation concepts. The level of openness may, however, vary. The model below illustrates this concept further, as

[1] In April 2011 this was 0.62% as many results – 1 380 000 results displayed when searched on Google, showing a consistent trend over the 6-year period.

developed by Prof. Niek du Preez, CEO of the innovation and business improvement company Indutech together with the author.

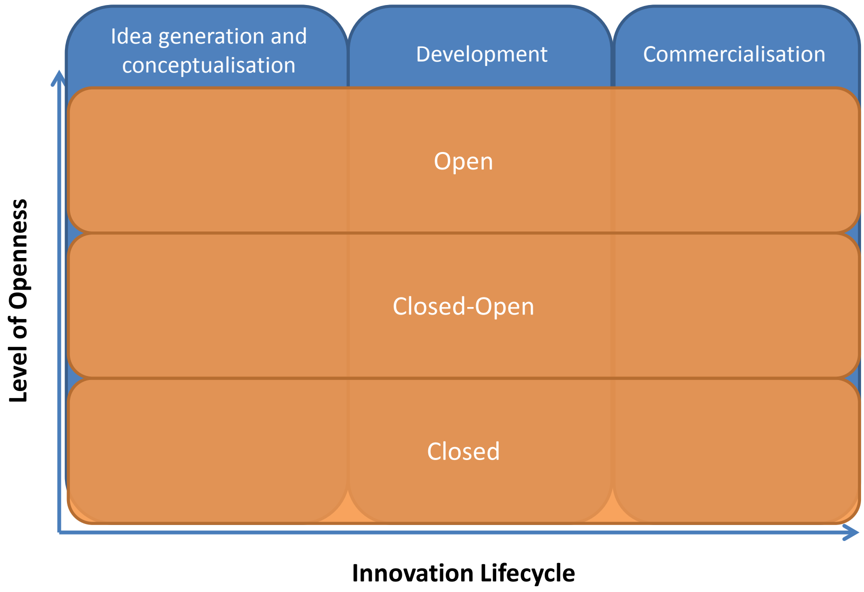


FIGURE 3-4: LEVEL OF OPENNESS MODEL

The model shows three layers or levels of innovation, being *Closed*, *Closed-Open*, and *Open*. This is then mapped across the innovation life cycle phases on a timescale. The organisation can at various stages of the innovation phases include or fluctuate between the different innovation layers. The levels in the model can be summarised as follows:

TABLE 3-2: LEVEL DESCRIPTIONS

Level	Description
Closed	No external input into the innovation phase.
Closed-Open	Highly controlled, limited external input into the innovation phase.
Open	Extensive external input into the innovation phase.

The *closed-open* level is introduced as a transition level between *closed* and *open* innovation. This can be where an organisation is only starting out on an open innovation journey or where openness is much more controlled, such as in a scenario where consultants are used for expert advice in the innovation process. This will provide external input, but will normally also be controlled through strict contractual limitations as to what information may be shared outside of the organisation's boundaries.

Various open innovation types can also be distinguished between. These open innovation types have different application and focus areas. Marais (2010) defines the following open innovation types:

- Platforming
  - Platforming is the technique of developing and introducing a base product with the purpose of providing a basis for prosumers to access, customise and exploit certain

facets of the base product to extend the capabilities of that product while adding value for all parties involved.

- Idea competitions
  - An idea competition is the technique of adapting an idea suggestion system to be more competitive by rewarding successful submissions (from inside or outside the organisation) financially, or in other forms related to the organisation.
- Customer immersion
  - Customer immersion is a technique whereby customers' inputs as to product requirements and expectations are exploited through intense customer interaction and the involvement of employees in, and their study of, the customer-product interaction process, with the assistance of new technologies.
- Collaborative product development
  - Collaborative product design and development is the technique of increasing the importance and responsibility of suppliers and customers in the product design process and supply chain to result in increased productivity to the benefit of the organisation, and eventually the customer.
- Innovation networks.
  - Innovation networks refers to the technique of incorporating the input from a network of contributors in the form of solutions to identified problems related to the hosting organisation in exchange for a reward in the form of an incentive.

Another important innovation type cited in literature is innovation brokering or innovation intermediaries. This was described by Chesbrough (2006: 139) as a company which focuses its “business on helping (other) companies implement various facets of open innovation” by helping “innovators use external ideas more rapidly” or helping “inventors find more markets where their own ideas can be used by others to mutual benefit”. Intermediaries can be in the form of “commercial and technical consultancies, to government departments, national and local development agencies, academic networks and university technology transfer offices” (Mortara, 2010).

Jeffrey Phillips proposed an open innovation typology to describe open innovation types using a two-axis model (Sloane, 2011). The model considered two attributes namely *Instruction* and *Invitation*. It then used two factors: 'suggestive' and 'directed' for the topics of innovation, and 'participative' and 'invitational' for the invitees. Figure 3-5 shows this model.

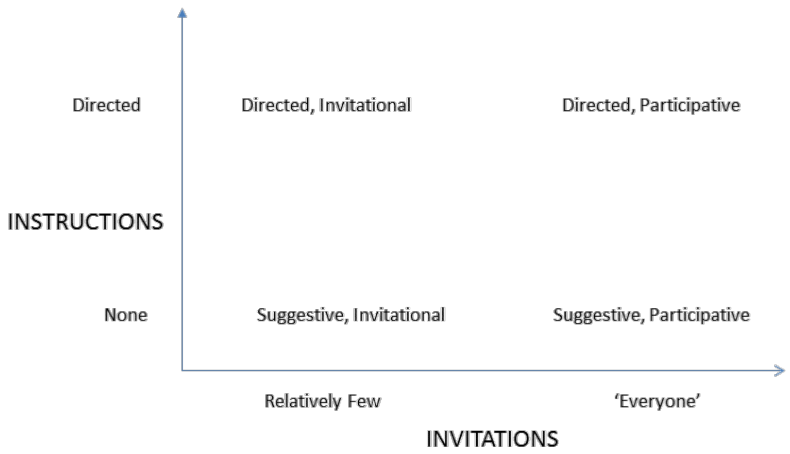


FIGURE 3-5: INNOVATION TYPOLOGY

When a company embarks on an open innovation journey, the company must decide which of the open innovation types to include in its strategy. Each type will have unique characteristics, applications and outcomes to consider before selection and implementation. It therefore also becomes important to understand what the open innovation requirements are for a company to determine the correct innovation type fit. These decisions should form part of an open innovation strategy defined by the organisation.

3.2 SMEs

SMEs are vital to the economic success of a country. "SMEs represent more than 95% of enterprises and ensure 60–70% of the jobs" as stated in a study conducted by the Organization for Economic Cooperation and Development (OECD) (Robu, 2013). SMEs therefore have a direct impact on a country's employment and GDP growth. "In the countries with a lower income per capita, SMEs have a higher impact on the employment level, about 78%, compared to countries with a larger income, where the percentage goes down to 59%" (Robu, 2013).

Small and medium-sized enterprises are classified in South Africa according to the criteria displayed in the next table (National Small Business Act, 1996). The SME classification uses three main factors being 1) number of employees, 2) turnover and 3) asset value.

TABLE 3-3: SME CLASSIFICATION

Sector or sub-sectors in accordance with the Standard Industrial Classification	**Size or class**	**Total full-time equivalent of paid employees** ***Less than:***	**Total annual turnover (Rand Million)** ***Less than:***	**Total gross asset value (fixed property excluded, Rand Million)** ***Less than:***
Agriculture	Medium	100	5	5
	Small	50	3	3
Mining and Quarrying	Medium	200	39	23
	Small	50	10	6
Manufacturing	Medium	200	51	19
	Small	50	13	5
Electricity, Gas and Water	Medium	200	51	19
	Small	50	13	5
Construction	Medium	200	26	5
	Small	50	6	1

Sector or sub-sectors in accordance with the Standard Industrial Classification	Size or class	Total full-time equivalent of paid employees *Less than:*	Total annual turnover (Rand Million) *Less than:*	Total gross asset value (fixed property excluded, Rand Million) *Less than:*
Retail and Motor Trade and Repair Services	Medium	200	39	6
	Small	50	19	3
Wholesale Trade, Commercial Agents and Allied Services	Medium	200	64	10
	Small	50	32	5
Catering, Accommodation and other Trade	Medium	200	13	3
	Small	50	6	1
Transport, Storage and Communications	Medium	200	26	6
	Small	50	13	3
Finance and Business Services	Medium	200	26	5
	Small	50	13	3
Community, Social and Personal Services	Medium	200	13	6
	Small	50	6	3

"In South Africa, it is estimated that about 80 percent of the formal business sector and 95 percent of the total business sector (including informal) can be considered to be SMEs or micro enterprises (MEs), accounting for about 46 percent of total economic activity, 84 percent of private employment and 97.5 percent of all newly registered businesses" (International Institute for Sustainable Development, 2004). Unfortunately however, it is estimated that seventy-five percent of new SMEs established in South Africa fail within the first two years of existence (Fatoki and Odeyemi, 2010).

During the National Council Of Provinces (NCOP) budget vote speech delivered by the Deputy Minister of Trade and Industry in June 2011, it was highlighted that the South African Government saw the SME sector as "critical in stimulating economic development, and that it is also a pivotal area in terms of innovation, skills development, entrepreneurship, labour-absorption and job-creation". This is an important development strategy from the South African Government, considering the high unemployment rate in South Africa of roughly 25 percent.

The above two paragraphs emphasise the importance of SMEs in South Africa and the need to improve the capabilities within the SME environment to ensure sustainability and growth due to the impact SMEs have on the economy. Increasing innovation capability can therefore be one area of focus to support this objective.

3.3 Open Innovation in SMEs

There has been little research conducted on open innovation processes in small and medium-sized enterprises (SMEs) with most research being focused instead on large enterprises (Chesbrough, 2010; Bianchi et. al. 2010)[2]. "SMEs are the largest number of companies in an economy, but they are underresearched in the open innovation literature" (Gassmann et. al., 2010). Rahman and Ramos (2010) observe that "to provide innovative services or products to the outer periphery of the customer chain, SMEs play an important role" and that "focusing innovation for SMEs would lead to a newer dimension of innovation research for better business and economic growth".

Research is showing that open innovation is becoming increasingly popular among SMEs, opening up their innovation processes (Van de Vrande et al., 2008; Gassmann et al., 2010). It is, however, important to understand the reasons for and results of using open innovation by SMEs. This will help with the argument for why SMEs should consider using open innovation in their organisations and provide support for research relating to this topic. This will also help to answer the first secondary research question posted in chapter 2.

Open innovation within SMEs has its own unique opportunities but also very specific challenges. Brunswicker (2009) mentions some of these as described in Figure 3-6.

These challenges are confirmed by various authors. Bianchi et al. (2010) stated that open innovation "can be particularly challenging for small and medium-sized enterprises, because of their focused business portfolio, specialized knowledge basis, and limited financial resources that can be devoted to innovation activities" and further cite the following challenges for SMEs:

- Lacking the resources and capabilities in manufacturing, distribution and marketing, which are the key for transforming inventions into new products and processes.
- Identification of promising applications where to commercially exploit proprietary technologies, which are usually in completely different industries from the firm's own product business.

[2] A search on Google in February 2017 provided 154 000 results when searching for the words 'open innovation' and 'SME'. This compared to the more than 3 million results for 'open innovation' only. It seems that open innovation in SMEs is not just an underresearched topic in the academic field, but also an underrepresented topic within innovation in general.

FIGURE 3-6: CHALLENGES AND OPPORTUNITIES FOR OPEN INNOVATION IN SMES (ADAPTED FROM BRUNSWICKER, 2009)

Van de Vrande et al. (2008) and Vanhaverbeke (2012) also emphasised the lack of internal resources and market reach of SMEs to commercialise new products, requiring them to collaborate with external, often larger partners for innovation success. Huizingh (2011) states that having less resources poses a challenge to SMEs to "build and maintain collaborative networks and to create and enforce intellectual property rights".

Spithoven et al. (2013) also mentioned that SMEs tend to have "less formalised internal R&D procedures and a different set of network characteristics than large firms" and that these organisations may "face more risks associated with OI than large companies, such as becoming overly dependent on outside parties". The dependency is created due to neglecting to develop strong technological competences internally when engaging in open innovation (Vanhaverbeke et al., 2002). Making intellectual property available to external parties may also cause increased competition for SMEs (Fosfuri, 2006).

Interesting though, is that the main barrier to open innovation adoption in SMEs, stated as a lack of resources, is also put forward as one of the main drivers for "SMEs to look beyond their organisational boundaries for required knowledge and technological ideas" (Spithoven et al., 2013). Research from Chesbrough and Crowther (2006) further suggested "that the search for growth, in revenues and in new products", drives the adoption of open innovation by SMEs. The same conclusion was reached by Van de Vrande et al. (2009), who stated that "open innovation in SMEs is mainly motivated by market-related targets: SMEs make use of several open innovation practices at the same time to serve customers effectively or to open up new markets, with higher-order objectives to secure revenues and to maintain growth".

Work by Hemert et al. (2013) as referenced by Hossain (2015) "demonstrated that SMEs' interaction with sources of innovation is important not only in the recognition phase of the innovation process but also at the end stage of the innovation process for the successful commercialisation of a product or a service". It is important to also recognise that "open innovation is as relevant for service firms as it is for manufacturing firms" (Van de Vrande et al., 2008).

Chesbrough (2010) stated advantages of open innovation for SMEs such as:

- Size - Their smaller size makes smaller markets attractive to SMEs while these markets would not be attractive for larger firms. As well, this advantage allows SMEs to exploit new trends sooner when entry costs are still quite low. Large firms cannot follow because their overhead costs are too high to be cost-effective in niche markets.
- Focus - Their focus lets them execute very effectively against larger, diversified firms with more diffuse objectives. The sharp focus on a particular market, customer type, expertise or technology may generate a sustainable competitive advantage in industries where customers value the expertise, knowledge or service that this type of SME offers.
- Business specialisation - SMEs can specialise their business more deeply in narrow fields. One aspect of open innovation is the growing role that markets are playing in organising and coordinating innovative activities. The growth of these innovation markets offers greater rewards for specialisation since those specialised firms can often sell their capabilities to a wider range of customers and markets.
- Entrepreneurial persons - SMEs attract more entrepreneurial R&D employees. Product and market orientation is higher than in larger research departments of large firms. This creates a bias to action in smaller firms and promotes extensive experimentation with alternative business models. In many innovative situations, identifying and executing an effective business model is as important as or more important than developing a new technology.
- Speed - Smaller firms take decisions faster and implement them more rapidly. Smaller firms can react more quickly to input from customers or challenges from competitors, and evolve their business models more rapidly. In many cases, they can learn faster than larger firms and they are faster in decision-making so they potentially have a competitive advantage in fast-changing markets.

These advantages can lead to the following opportunities for SMEs according to Chesbrough (2010):

1. Large companies are increasingly interested in collaborative innovation partnerships: Smaller firms with strong competences in focused specialties make attractive collaboration partners for larger firms. Indeed, the SMEs' expertise can accelerate the completion time for a larger firm's innovation initiative. Moreover, open innovation and open commercialisation are characterised by a network of alliances and long-term deals between different organisations with complementary roles in the value chain. In this way, interorganisational networks create new business opportunities for specialised SMEs.

2. Large companies creating technology platforms and actively recruiting SMEs to develop products for these platforms: Platform leaders provide extensive technical information, co-marketing opportunities and even occasional subsidies for smaller firms' R&D costs.

3. User innovations: SMEs are active users of many new technologies and may develop important enhancements for these technologies that improve the quality or capability of a technology. Many large companies are eager to join these open innovation communities. It may even serve the purposes of large firms better to allow the smaller firms to be seen as the leaders of these communities.

4. Globally successful SMEs, which also are known as "hidden champions" because of their high profitability, have developed a niche strategy as the source of competitive advantage: They work in narrow market segments where large firms are not interested because of the limited market potential.

But smaller firms have penetrated markets in many regions of the world, thus enabling the SMEs to achieve scale economies with common suppliers and by serving key customers.

5. Open-source development provides benefits for the innovation efforts of all firms independent of their size: The main benefits are based on higher reuse of code in comparison to proprietary software, greater robustness of the system due to strict peer review and thus the application of the Darwinist selection principle "the best code survives".

6. Open innovation is fundamentally about the greater intrusion of markets into the processes of R&D: SMEs have a greater ability to specialise than larger firms, and this specialisation is more helpful precisely when markets are more available for innovative activities. Internally organised activities are restricted to a single captive customer in a single market. Open innovation activities seek to cultivate multiple customers in multiple markets for that innovative activity, spreading costs and risks of adoption more widely.

Claims promoting the benefits of open innovation were further demonstrated by Ziltener & Wagner (2008) in their research showing “how innovation weaknesses and barriers of SMEs can be overcome by integration in a regional, open innovation system”. Lichtenthaler (2008) proposed the commercial exploitation of technology outside the organisation’s own markets and industries as a key benefit of open innovation, with Lee et al. (2010) noting the use of technology out-licensing as a “strategic approach to increase the economic returns from their technology investments, without building or acquiring costly downstream complementary assets” (Bianchi et al., 2010).

Results from an analysis of open innovation practices within four European economies indicated that open innovation has a “strong impact both on the capacity for novel innovation and on actual innovation performance” (Ebersberger et al., 2010). Their research further suggested that although open innovation practices are less common in SMEs than in larger organisations, it has an important impact on innovation performance of practising organisations. They concluded though that a “broad-based, holistic approach to open innovation may give greater returns than a deep focus on a single aspect” (Ebersberger et al., 2010).

Vanhaverbeke (2012) promoted the use of open innovation in SMEs, seeing it as a logical approach for these size organisations given his research that had shown “that firms that know how to manage a network of innovation partners can seize new business opportunities, become key players in growth industries and turn themselves into highly profitable companies”.

It has further been shown that open innovation can help smaller organisations overcome the barriers of being small and having limited resources by introducing more open innovation processes (Keupp and Gassmann, 2007). It can further increase the speed with which new products and services can be commercialised (Laursen and Salter 2006).

Spithoven et al. (2013) also found that open innovation resulted in a positive effect on the introduction of new products and services into the market. Open innovation further contributed to organisational revenue achieved from these new commercial activities. Their research indicated that the probability of introducing new products or services increased when collaborating with external partners. Collaboration with open innovation partners opened up strategic options to SMEs not otherwise accessible to them (Colombo et al., 2014). Zeng et al. (2010) showed a significant relationship between “interfirm cooperation, cooperation with intermediaries, cooperation with research organisations, and innovation performance”. The protection of intellectual property is, however, important to increase the share of revenue for the SME (Spithoven et al., 2013).

Technology sourcing leads to an improvement in an organisation's radical innovation performance, whereas technology scouting is more beneficial for organisations aiming to improve incremental innovation performance (Parida et al., 2012). A study by Tomlinson (2010) suggested that vertical collaboration had a positive impact on innovation performance, but the strength of such ties was important to realise the full benefits. Laursen and Salter (2006) found among UK SMEs that innovation performance took on an inverted U-shape when opening up the innovation process. Performance would increase up to a point when adding external partners and sources to the innovation processes, after which performance would start to diminish due to the increased resource burden on the organisation.

Spithoven et al. (2013) stated that "SMEs are more effective in using different OI practices simultaneously when they introduce new products onto the market, whereas this is less the case for large firms". They further concluded that "turnover from new products in SMEs is driven by intellectual property protection mechanisms, while large firms benefit more from their search strategies".

Chesbrough and Crowther (2006) identified through their research that successful adoption of open innovation needs to be supported through "clearly defined open innovation practices, systems, roles, and responsibilities", maturing from ad hoc activities.

In a quantitative analysis of European SMEs, it was found that an organisation's internal practices for innovation enabled the SME to acquire the full value from open innovation strategies and actions (Brunswicker, 2011). Further, the research from Brunswicker (2011) derived that these practices for innovation "represent organisational antecedents of a firm's ability to successfully search, transform and exploit external innovation inputs. To create value from openness, operational proficiency in managing innovation internally is not sufficient. Strategic coordination, financial dedication towards innovation, and a culture for innovation should be successfully in place".

Brunswicker's research concluded that SMEs that do not open up their innovation processes could miss out on opportunities otherwise available to them through open innovation and external collaboration approaches. It is however noted that "it matters how firms open up their innovation processes, with whom and how they interact when searching for new ideas and whether they engage in dense codevelopment partnerships. Some innovation sources positively affect a firm's innovation performance, whilst others do not. Furthermore, it makes a difference how firms involve various innovation partners simultaneously" (Brunswicker, 2011).

The literature review provided has shown that open innovation improves the overall innovation performance of SMEs. Huizingh (2011), however, stated that "relevant theories and models for managers are not well-established in the literature". Open innovation can be beneficial for SMEs, but it requires an integrated and managed organisational approach.

Brunswicker and Ehrenmann (2013) proposed that SMEs would have to develop "new managerial capabilities" when adopting open innovation in their organisations. SMEs need to learn when and how to use different open innovation methods and interventions. For instance, open innovation can lead to high transaction costs (Christensen et al., 2005), so SMEs need to make trade-off decisions about breadth and depth of networks they engage in for innovation (Huges, 2009), with Theyel (2013) finding that SMEs prefer networking with customers over suppliers.

The strategies and interventions that SMEs select, should be dependent on the outcome they would like to achieve. Vertical collaboration can lead to better radical innovation whereas horizontal collaboration promotes incremental innovation (Parida et al., 2012). Strong patenting practices enabled technology out-licensing to external parties (Andries and Faems, 2013).

Tranekjer and Søndergaard (2013) found among Danish SMEs that project costs reduced when collaborating with external partners and customers on innovation, but that the degree of novelty in new products could be lower when SMEs are locked in with suppliers. For high-tech SMEs, Parida et al (2012) found technology scouting as a low-cost, yet effective open innovation option.

Customers are an important source of innovation for SMEs focusing on technology exploration, involving them in innovation processes through market research, crowdsourcing or tracking product modifications and adaptions (Von Hippel, 2005; Van de Vrande et al., 2009). These practices often tend to be preferred over more expensive and resource intensive practices such as IP licensing, venturing and external participation which require more substantial investments from the organisation (Van de Vrande et al., 2009). However, a warning from Brunswicker (2011) was that “in turbulent environments an active involvement of customers is not associated with a higher innovation performance”.

3.4 Chapter Conclusion

This chapter introduced the background to this research through a literature review. The important role that SMEs play within a country’s economy was emphasised, especially in emerging economies such as that of South Africa, where a large portion of the population is employed by SMEs.

Innovation is a key requirement for the sustainable competitiveness of an organisation. Open innovation is one innovation method that is getting more attention in research literature, due to the benefit of gaining access to additional skills and capabilities through this method, rather than just being reliant on an organisation’s own knowledge. It opens the organisation’s innovation boundaries to allow knowledge to flow into the organisation and to capture additional value from its own knowledge in new ways.

Open innovation in SMEs is still an evolving practice, lagging that of the application in larger organisations, which receives much more attention in the literature. There is a need to expand the literature around utilising open innovation in SMEs as an innovation method and how this may be similar to or different from that for larger organisations.

The first secondary research question defined in chapter 1 was *Why should SMEs consider using open innovation?* This chapter provided an overview of open innovation in SMEs, showing that there are various barriers to adopting this approach to innovation. However, SMEs can also greatly benefit from open innovation, increasing their innovation performance. Various studies have shown a positive impact on innovation performance and revenue from open innovation in SMEs. It can also help SMEs overcome their barrier of smallness, allowing them access to more resources to reduce their time to market and improve market reach and commercialisation. Open innovation allows SMEs to obtain technology and IP otherwise not available to them, to incorporate into their products and services.

From the literature, it seems evident that there is a strong argument for SMEs to consider open innovation as a strategic innovation approach. It answers the first secondary research question on why SMEs should consider open innovation. There is, however, a caveat to the adoption of open innovation. From the literature, it is suggested that open innovation should be a managed approach to obtain the full value from it, rather than an ad hoc activity.

The reviewed literature expanded on the problem statement from chapter 1 and provided further motivation for the research study and the need for an open innovation approach. Open innovation is still underrepresented in the literature. This research dissertation can further contribute to the body of knowledge on open innovation, especially its use within SMEs. It will contribute to an important segment of the economy – assisting SMEs with innovation – and also provide academic research insight into the topic of open innovation in SMEs.

Chapter 4: Open Innovation in South African SMEs

This chapter will focus on a study that was done of South African SMEs to understand the appetite for and use of open innovation within their organisations. It will outline the methodology used within the study, the results and some conclusions based on the results obtained. It will further also explain how the study informed the development of the open innovation approach. The results from the survey were published in the proceedings of two conferences and one academic journal article.

4.1 Introduction

An exploratory survey was conducted among South African SMEs at the start of this research in 2012 to better understand the appetite for open innovation and how open innovation practices were used by them. Academic research regarding open innovation within South African SMEs is very limited. This survey therefore provided an opportunity to expand the understanding of this topic, but also to confirm the relevance of the research problem and the need for a solution. It also served to answer the second of the secondary research questions:

SRQ2: What is the appetite for and use of open innovation in SMEs within South Africa?

This dissertation was done at a South African university, making it relevant to conduct the study with South African SMEs. Some elements of the research results were, however, compared to other international studies to understand any similarities or differences. The survey provided a good view into open innovation practices being employed within South African SMEs and their general understanding of the topic.

4.2 Methodology

The survey was conducted with a contained group of SMEs belonging to various South African SME forums on LinkedIn. A total of 531 invitations were sent out individually to people on the different forums. An initial screening process was followed before an invitation was sent out, to make sure that the recipient would fit the targeted audience of being a South African SME. Sometimes international members would join the South African forums, so these were excluded if it could be determined from their profiles that they were not South African. As an additional measure, however, the survey also included a filtering question asking if the participant was indeed from a South African registered SME. This was done to ensure that responses were not included that fell outside of the boundaries of the research study.

Five different forums were chosen on LinkedIn to be included in the survey study. The first forum was the South African Small Medium Enterprises Federation (SASMEF). It has over 1 700 members and is considered one of the largest SME forums for South African SMEs on LinkedIn, therefore providing good reach for the study. The SASMEF provides the following description on LinkedIn:

SASMEF is the unified voice of SMEs, assisting government and the corporate sector to create a SME friendly economy through lobbying & advice, developing the ability of business associations and SMEs through capacity building and creating collaboration by building a database of accredited SMEs available to supply to government and corporates.

South Africa has nine provinces. Three of the provinces are responsible for the largest part of its GDP. Gauteng, KwaZulu-Natal and the Western Cape collectively contribute over 60 percent to the country's GDP according to Statistics South Africa (South African Government). It was therefore decided to also include business clubs from major cities within those provinces in the survey pool. The cities included were Johannesburg and Pretoria (from Gauteng), Cape Town (from Western Cape) and Durban (from KwaZulu-Natal).

Following is the list of forums selected plus the number of survey requests sent to each.

TABLE 4-1: SME FORUM NAMES

LinkedIn Forum Name	Number of Invites
South African Small Medium Enterprises Federation	169
Cape Town Business Club	107
Pretoria Business Club	100
Johannesburg Business Club	78
Durban Business Club	77

A pilot was performed prior to the survey being sent to the above groups. The pilot included three SMEs known to the author, to ease the process of receiving feedback on the survey. Feedback received from the pilot included a request for more information/definitions to clarify some of the concepts and questions. It was also suggested that explanatory information could be better positioned within the flow of the survey. After the survey was updated, it was sent out to the 531 recipients.

4.3 Survey Design

The survey comprised of 27 questions, grouped into three categories. It first asked about:

1) *Innovation* in general within the organisation (9 questions) to get an understanding of the organisations' views and application of innovation, then it explored

2) *Open innovation* (11 questions) to understand how organisations apply open innovation practices as a way to innovate and then asked about

3) *Demographics* (7 questions).

The full questionnaire can be seen in Appendix A. Every category was introduced with an explanatory paragraph to explain the intention of the section to be covered. Definitions were also provided throughout, not assuming that the participants would have prior knowledge relating to the open innovation terms being used.

The survey included various question types, including Likert scale questions (Agree strongly; Agree slightly; Neither agree nor disagree; Disagree slightly; Disagree strongly), yes/no, and category option questions.

The survey was conducted using the survey tool *SurveyMonkey*. This eased the process of distribution and analysis within the study. The full response data set was downloaded from the tool for further analysis using Excel. The survey ran from March 2012 to May 2012. Completion of the results was voluntary, with no reward offered for participation, other than a link to a free e-book on the topic of open innovation and the option to receive the results of the survey if they so wished.

4.4 Survey Results

The following section provides an overview of the survey results, highlighting some key findings and accompanying observations from the author based on the outcomes. A full discussion of the survey results can be found in Appendix A.

A total of 108 responses were received at the end of the survey period. After applying the filter criteria to focus only on South African SMEs, 23 responses had to excluded, leaving 85 responses to be used in the assessment. This provided a qualified response rate of 15.9 percent for the survey.

Thirty-three percent of the responses received were from IT-related SMEs. The results will therefore be reported in this chapter, showing all the responses combined as well as the split between IT and non-IT responses. This should highlight any skewedness in the overall results due to the high IT industry response rate and contrast any differences between IT and non-IT SMEs. The survey response percentages are indicated showing the three categories of All responses, Non-IT responses, and IT-only responses by the following notation {All%;Non-IT%;IT%} when discussed in paragraph form and not shown in table format.

4.4.1 SME Characteristics

Most SMEs in the survey had between 1 and 10 employees in their organisations, but IT-related SMEs showed higher employee counts with 11 percent of IT organisations having more than 100 employees.

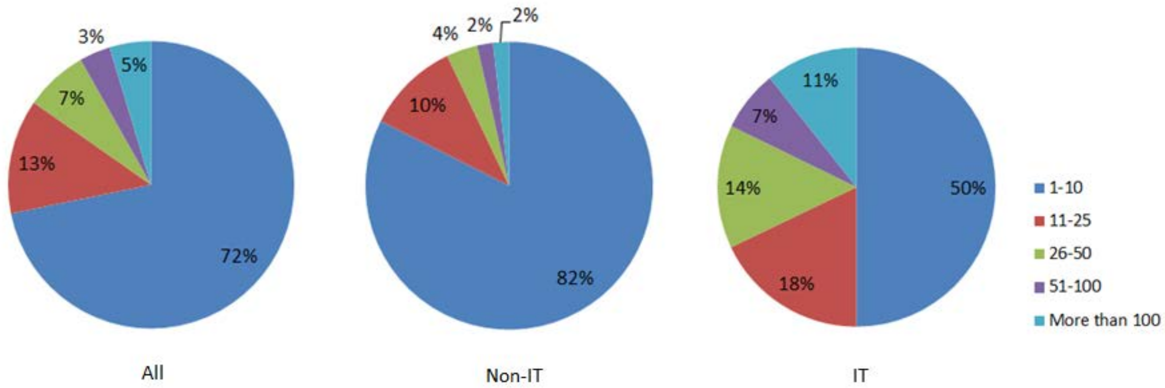


FIGURE 4-1: EMPLOYEE NUMBERS

Responses were received from 14 different industries, with Information Technology (32.9 percent), Educational Services (11.8 percent), Professional, Scientific and Technical Services (10.6 percent) and Management of Companies and Enterprises (10.6 percent) dominating the categories.

Respondents were mostly owners of the organisation, which should aid in the accuracy of the responses relating to their own organisations.

TABLE 4-2: RESPONDENT ROLE

Organisational Role	All	Non-IT	IT
Owner	76.5%	84.2%	60.7%
Manager	15.3%	12.3%	21.4%
Specialist	8.2%	3.5%	17.9%

A very interesting statistic from the survey was the number of years the SMEs had been in operation. More than 75 percent of the organisations had been in operation for more than three years with more than 28 percent having been in operation for more than 10 years. These were therefore well-established organisations.

TABLE 4-3: NUMBER OF YEARS IN OPERATION

Years in Operation	All	Non-IT	IT
Less than 1	7.1%	10.5%	0.0%
1 to 2	14.1%	10.5%	21.4%
3 to 5	28.2%	29.8%	25.0%
6 to 10	22.4%	21.1%	25.0%
More than 10	28.2%	28.1%	28.6%

4.4.2 Innovation

The survey participants were first asked about innovation in general, to establish their innovation activity and views. Most respondents classified their organisations as being innovative. This response could however have a strong bias, given the high percentage of owners within the survey sample.

TABLE 4-4: PERCEPTION OF BEING INNOVATIVE

Your Organisation is Innovative	All	Non-IT	IT
Agree Strongly	61.2%	57.9%	67.9%
Agree Slightly	25.9%	29.8%	17.9%
Neither agree nor disagree	7.1%	7.0%	7.1%
Disagree slightly	5.9%	5.3%	7.1%
Disagree strongly	0.0%	0.0%	0.0%

Innovation was funded on an ad hoc basis with only 18.8 percent of overall respondents indicating that they have a separate budget line item for innovation. IT organisations do show a higher maturity in this category with 32 percent stating that they have a separate innovation budget compared to the 12 percent of non-IT respondents.

TABLE 4-5: SMES HAVING A SEPARATE INNOVATION BUDGET

Separate budget	All	Non-IT	IT
Yes	18.8%	12.3%	32.1%
No	81.2%	87.7%	67.9%

Although respondents considered their organisation to be innovative, they still lacked formalised innovation processes. Only 27.1 percent overall indicated that such a formal innovation process existed in their organisations. The IT SMEs however again had a higher rate of 42.9 percent compared to the 19.3 percent of Non-IT organisations.

It is interesting to note that despite the lack of formal innovation processes or dedicated innovation budgets, that the SMEs still reported a high level of innovation activity. Only about 10 percent of respondents indicated that they had not produced a new innovation during the 12 months prior to the survey. The question, however, only measured how many new innovations were launched into the market or internally and did not provide a view of the size, complexity, success or value of the innovation.

TABLE 4-6: NUMBER OF NEW INNOVATIONS

New innovations deployed into the market or implemented in-house in the last 12 months	All	Non-IT	IT
None	10.6%	10.5%	10.7%
1-3	63.5%	59.6%	71.4%
4-10	18.8%	21.1%	14.3%
More than 10	7.1%	8.8%	3.6%

Respondents were asked what types of innovation they applied in the year prior to the survey. Most popular was product innovation for both the IT and Non-IT SME groups. Business model and Strategy also received a lot of attention, with Process and Marketing coming out average.

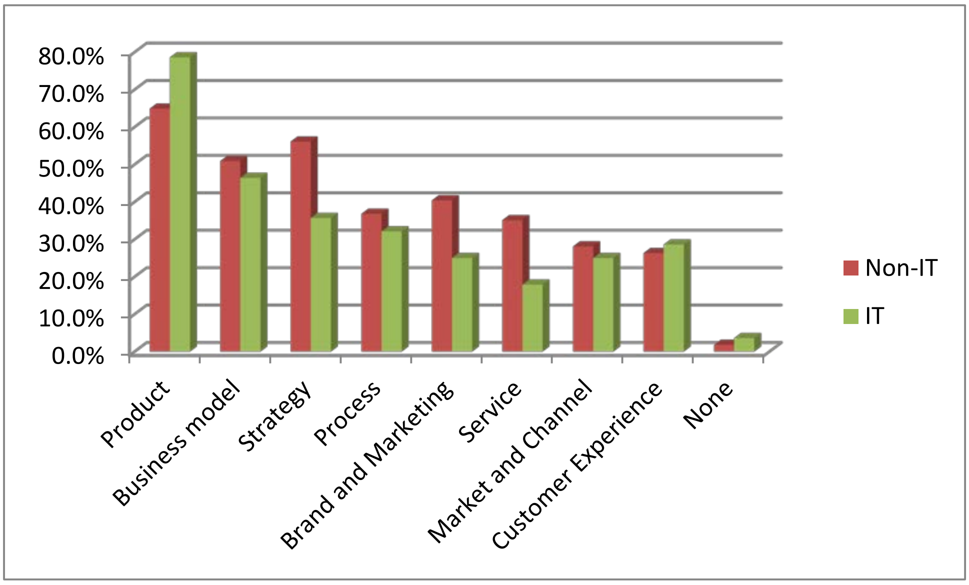


FIGURE 4-2: TYPES OF INNOVATION LAST 12 MONTHS

Organisations indicated that the trend to focus on Product innovation will remain for the next year but that there will also be more emphasis on Brand and Marketing innovation. Planned innovation within Market and Channel, Service and Customer Experience also scored high.

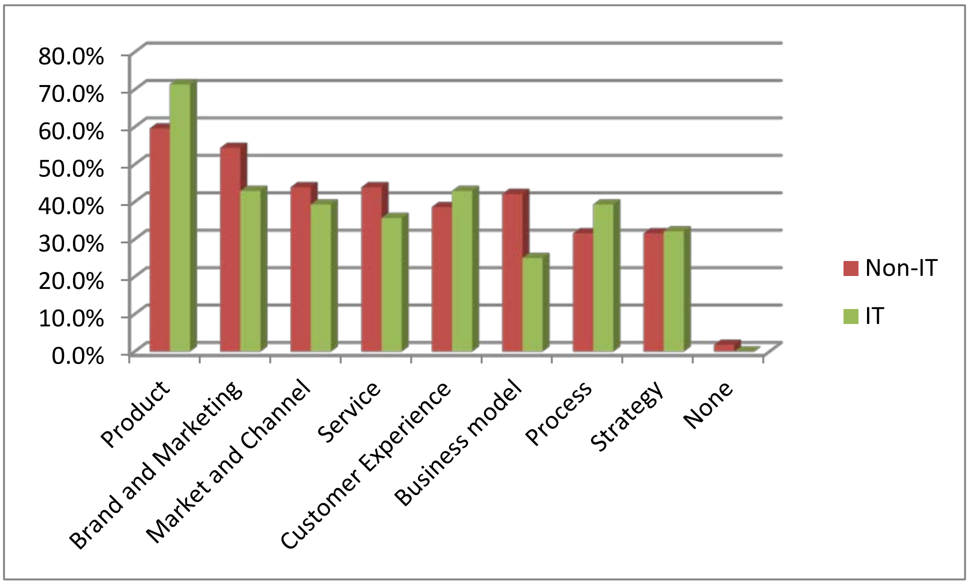


FIGURE 4-3: PLANNED INNOVATION NEXT 12 MONTHS

Organisations also mostly indicated that they consider innovation to be important for success in their respective industries with over 80 percent agreeing strongly to that statement. SMEs recognise the need to innovate to stay relevant in their markets.

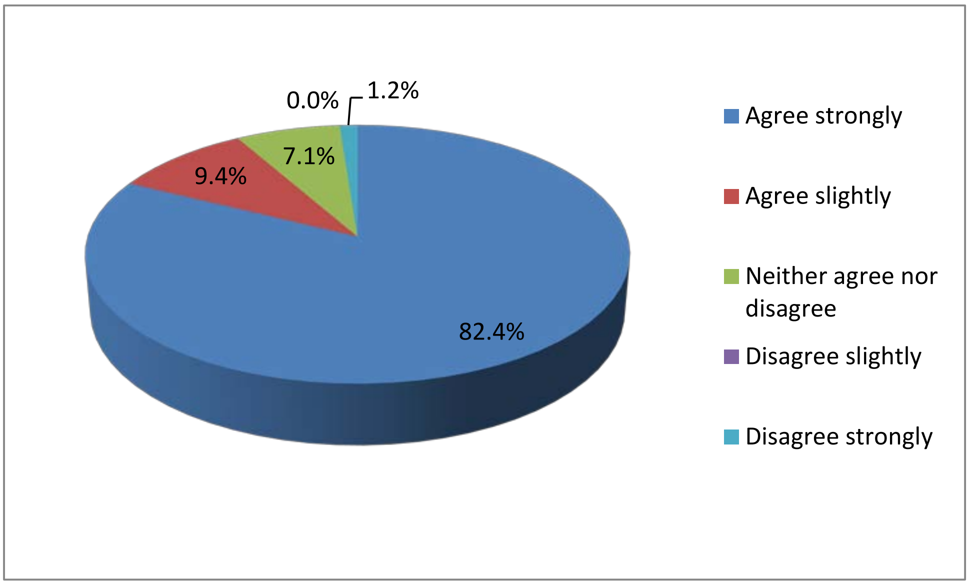


FIGURE 4-4: INNOVATION IS IMPORTANT

In 2012 GE conducted an innovation study of large organisations in their Global Innovation Barometer survey (GE, 2012). The survey showed that 85 percent of South African organisations agreed with the statement that more than ever before, SMEs and individuals can be as innovative as large companies. The same question was asked in this survey and 81.2 percent agreed with the statement, with IT-orientated SMEs being the most optimistic at 85.7 percent. It indicates a very positive attitude towards innovation and being able to compete against larger organisations to bring new products and services to the market.

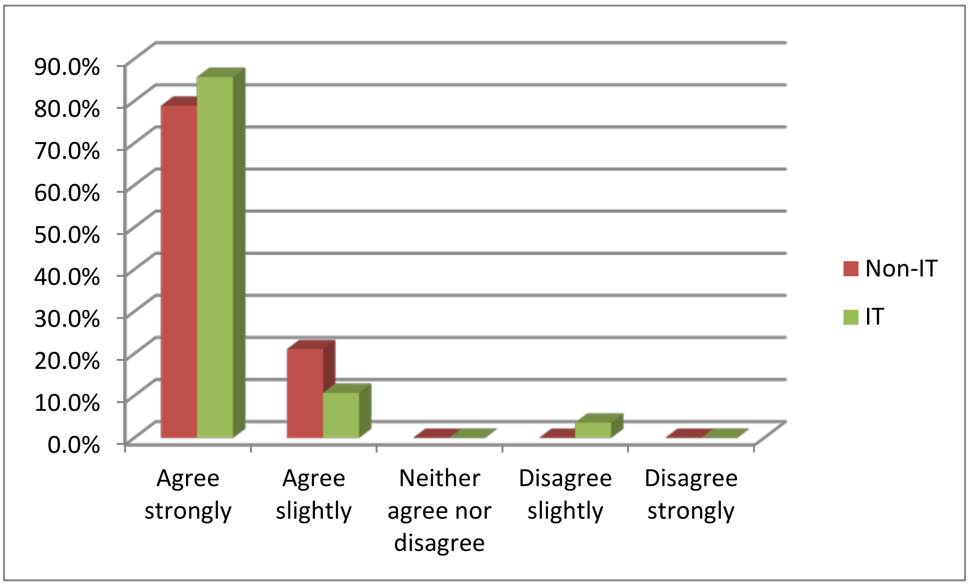


FIGURE 4-5: SMES CAN BE AS INNOVATIVE AS LARGE ORGANISATIONS

4.4.3 Open Innovation

The next section will cover the survey questions relating specifically to open innovation. Only 17.6 percent of survey respondents agreed strongly that they consider themselves knowledgeable on the topic of open innovation. This highlighted the need to educate SMEs more on the subject of open innovation and to formalise this concept more as an approach to innovation. The results were similar when extending the question to the understanding of open innovation within the organisation. About a quarter of respondents thought that their organisation's knowledge of open innovation was fairly low.

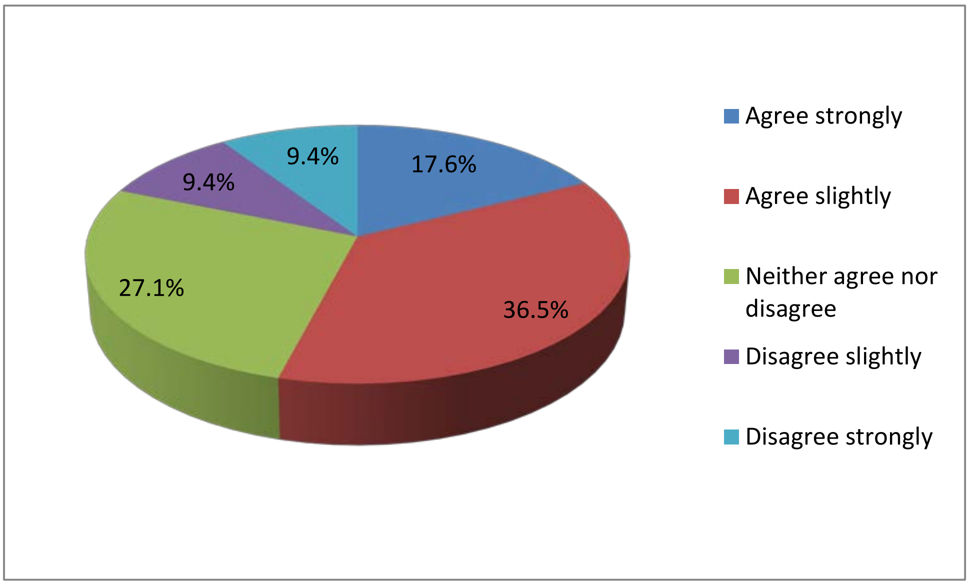


FIGURE 4-6: RESPONDENTS BEING KNOWLEDGEABLE ON OPEN INNOVATION

TABLE 4-7: ORGANISATION BEING KNOWLEDGEABLE ON OPEN INNOVATION

Our Organisation is knowledgeable about Open Innovation	All	Non-IT	IT
Agree Strongly	17.6%	15.8%	21.4%
Agree Slightly	32.9%	38.6%	21.4%
Neither agree nor disagree	23.5%	17.5%	35.7%
Disagree slightly	12.9%	12.3%	14.3%
Disagree strongly	12.9%	15.8%	7.1%

Interestingly enough, just over 60 percent of all respondents indicated that they were involved in some sort of open innovation activity in their organisations, either rolling it out, optimising it or relaunching their open innovation programmes. This was somewhat surprising considering the confidence level of participants regarding open innovation knowledge not being very high. It was positive to see the percentage of organisations that were optimising an ongoing open innovation programme. This might explain the confidence levels in their understanding of open innovation, showing that it is a learning process for these organisations where they still need to mature their capability.

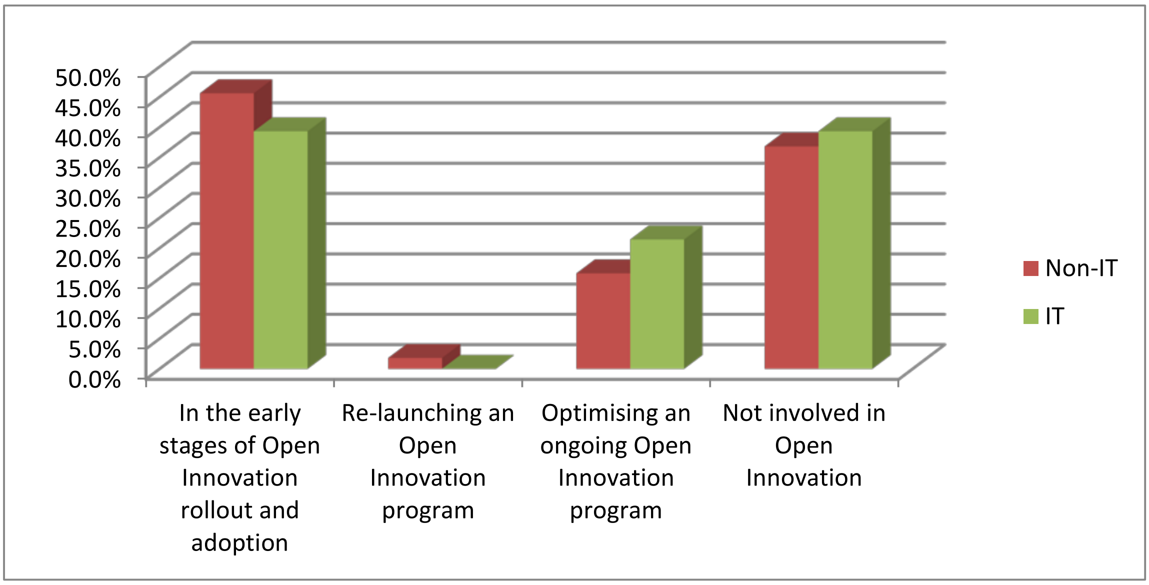


FIGURE 4-7: INVOLVEMENT IN OPEN INNOVATION

The question concerning where SMEs are on their open innovation journey was taken from the 2011 Open Innovation Scorecard Survey Report by NineSigma (2011). It is interesting to note that the responses in the South African survey (shown in Figure 4-7), compared closely to the responses provided by Middle Market Companies ($250M-$1B in Revenues) in the NineSigma report, which scored percentages of 42, 4, 17 and 37 for the respective above options in their study.

The literature describes various open innovation types. The survey results showed that Collaboration was the preferred open innovation type with more than 57 percent of the SMEs indicating that they have used that as an innovation method over the past 18 months. Customer Immersion, Platforming, Idea Competitions and tapping into Innovation Networks also proved popular. The least favourite method opted for was IP or Technology In-licensing or Acquisition, with less than 10 percent of the participants indicating that they have used this in the last year, even in IT organisations. This shows a potential opportunity for organisations to explore this method of open innovation within South Africa. A potential deterrent however may be the weakness of the South African currency against major foreign currencies, making IP acquisition from outside of the country's borders expensive.

TABLE 4-8: OPEN INNOVATION APPLICATION PREVIOUS 18 MONTHS

Open Innovation types used over the last 18 months	All	Non-IT	IT
Collaboration	57.6%	57.9%	57.1%
Customer Immersion	29.4%	26.3%	35.7%
Platforming	23.5%	21.1%	28.6%
Idea Competitions/Challenges	22.4%	22.8%	21.4%
Innovation Networks	22.4%	21.1%	25.0%
Lead Users	16.5%	8.8%	32.1%
IP or Tech Out-licensing or Selling	14.1%	12.3%	17.9%
Innovation Intermediaries	12.9%	12.3%	14.3%
IP or Tech In-licensing or Acquisition	5.9%	7.0%	3.6%

Collaboration was also considered the most likely open innovation method that SMEs would follow in the coming 18 months. There were, however, mixed responses about which methods other than Collaboration would be followed as can be seen in the next tables for Non-IT and IT responses respectively.

TABLE 4-9: OPEN INNOVATION APPLICATION NEXT 18 MONTHS (NON-IT)

Open Innovation types to be used over the next 18 months (Non-IT)	Highly unlikely	Unlikely	Likely	Very likely
Collaboration	6%	13%	38%	42%
Idea Competitions/Challenges	28%	23%	23%	26%
Customer Immersion	10%	16%	51%	24%
Platforming	29%	13%	35%	23%
Innovation Networks	20%	18%	43%	18%
Lead Users	26%	26%	33%	15%

Open Innovation types to be used over the next 18 months (Non-IT)	Highly unlikely	Unlikely	Likely	Very likely
IP or Tech Out-licensing or Selling	32%	32%	23%	14%
Innovation Intermediaries	31%	26%	33%	10%
IP or Tech In-licensing or Acquisition	36%	36%	25%	2%

TABLE 4-10: OPEN INNOVATION APPLICATION NEXT 18 MONTHS (IT)

Open Innovation types to be used over the next 18 months (IT)	Highly unlikely	Unlikely	Likely	Very likely
Collaboration	4%	15%	27%	54%
Customer Immersion	13%	4%	48%	35%
Lead Users	14%	14%	33%	38%
Platforming	9%	9%	55%	27%
Idea Competitions/Challenges	9%	32%	32%	27%
Innovation Networks	8%	25%	42%	25%
IP or Tech Out-licensing or Selling	32%	27%	18%	23%
Innovation Intermediaries	20%	40%	25%	15%
IP or Tech In-licensing or Acquisition	40%	30%	20%	10%

For easier comparison, a single score per preferred innovation approach is calculated. A weighted score (-1, 1, 5, 9 from highly unlikely to highly likely) was assigned to each answer option and then each percentage was multiplied by the weighted score. The scores per row were then added together resulting in a single score. This provided a preference ranking based on the survey results. The next table shows the results from highest to lowest preference after applying the weighted scores.

It shows that IP in- and out-licensing are not heavily preferred by South African SMEs. Making use of Intermediaries is also not a practice that SMEs rely on with their open innovation efforts.

TABLE 4-11: PREFERRED OPEN INNOVATION TYPES – WEIGHTED SCORES

Preferred Open Innovation Types (overall)	Weighted Score
Collaboration	5.97
Customer Immersion	4.95
Platforming	4.14
Innovation Networks	4.03
Idea Competitions/Challenges	3.70
Lead Users	3.66
Innovation Intermediaries	2.58
IP or Tech Out-licensing or Selling	2.55
IP or Tech In-licensing or Acquisition	1.56

Participants were asked who they would consider as an ideal innovation partner to develop new innovations with. Customers came out as clear favourites, but the other partner options had mixed responses. Similar to the open innovation types, the results were processed with weighted scores to determine the preferred partners overall as can be seen in Table 4-12.

Customers and Suppliers were considered to be the preferred innovation partners, with Government agencies being the least preferred.

TABLE 4-12: PREFERRED INNOVATION PARTNERS – WEIGHTED SCORES

Preferred Open Innovation Partners (overall)	Weighted Score
Customers	6.66
Suppliers	5.41
Consultants	4.56
Universities and other academic institutions	4.38
Non-competitor companies	3.93
Technology transfer offices	2.58
Competitor companies	2.41
Government development agencies	1.67

Participants were very positive about open innovation being considered an effective innovation model.

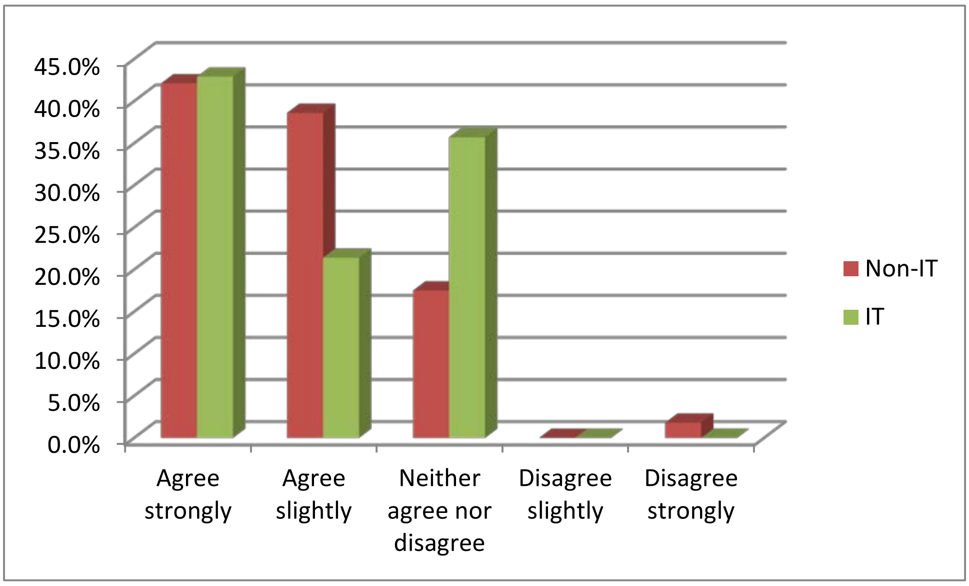


FIGURE 4-8: OPEN INNOVATION AS AN EFFECTIVE INNOVATION MODEL

Asking participants if they thought open innovation was a viable innovation method for their organisations received a similar result to the previous question. Participants were mostly positive about the idea. This could have been expected, considering the high percentage of respondents who said that they are either in the process of open innovation roll-out or optimisation. It is even more encouraging, considering the close to 40 percent who indicated that they were not currently involved in any open innovation activity, providing potential for wider adoption.

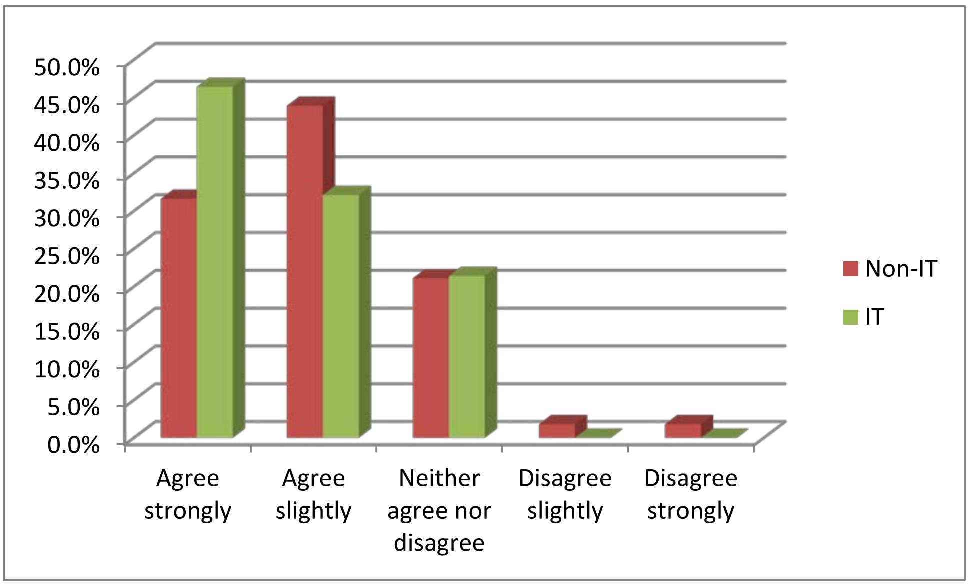


FIGURE 4-9: OPEN INNOVATION AS A VIABLE INNOVATION METHOD FOR THEIR ORGANISATION

Participants were asked to select their top 3 barriers to using open innovation. Finance and Resources were selected as the biggest barriers to using open innovation. Non-IT organisations marked

Knowledge as their third-highest barrier, with IT organisations selecting Organisation/Culture to be a significant barrier.

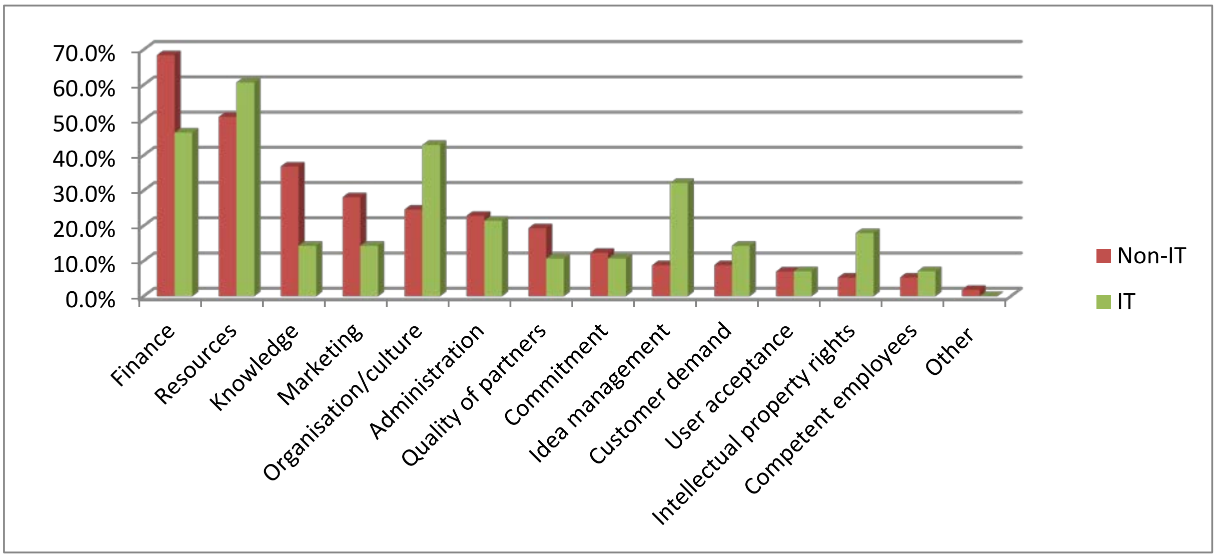


FIGURE 4-10: BARRIERS TO OPEN INNOVATION

The above question was taken from an open innovation research study of Dutch SMEs (Van de Vrande et al., 2008). That study indicated Organisation/Culture as the main barrier and Administration as the second-highest barrier. It is interesting to note that intellectual property rights (IP) was not rated as a significant barrier by the South African SMEs, although this area receives a lot of attention in literature as a barrier to open innovation adoption.

When asked to rate their use of open innovation compared to other organisations in their industry, respondents typically rated it to be higher or the same as industry average, with only around 15 percent of respondents rating themselves below industry average. There seems to be an element of self-bias in organisations' innovation maturity and capability assessments.

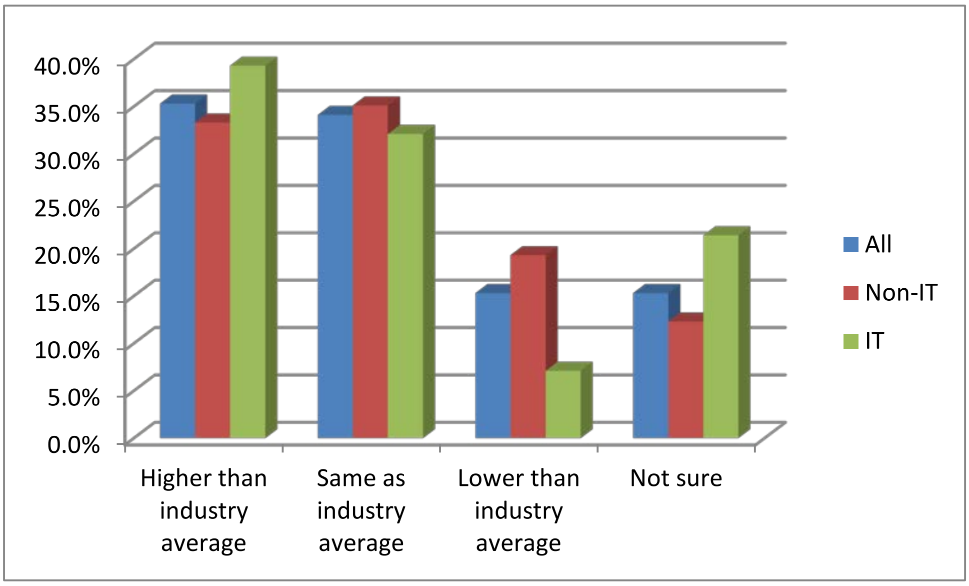


FIGURE 4-11: ORGANISATIONAL USE OF OPEN INNOVATION COMPARED TO INDUSTRY

When asked if the understanding of open innovation in their organisations was sufficient to pursue open innovation initiatives without assistance, almost 30 percent of respondents disagreed, with another 30 percent answering neutrally to the question. So, although a large percentage of respondents indicated that their organisations are embarking on open innovation, they also indicated that they are not all that confident in doing so on their own.

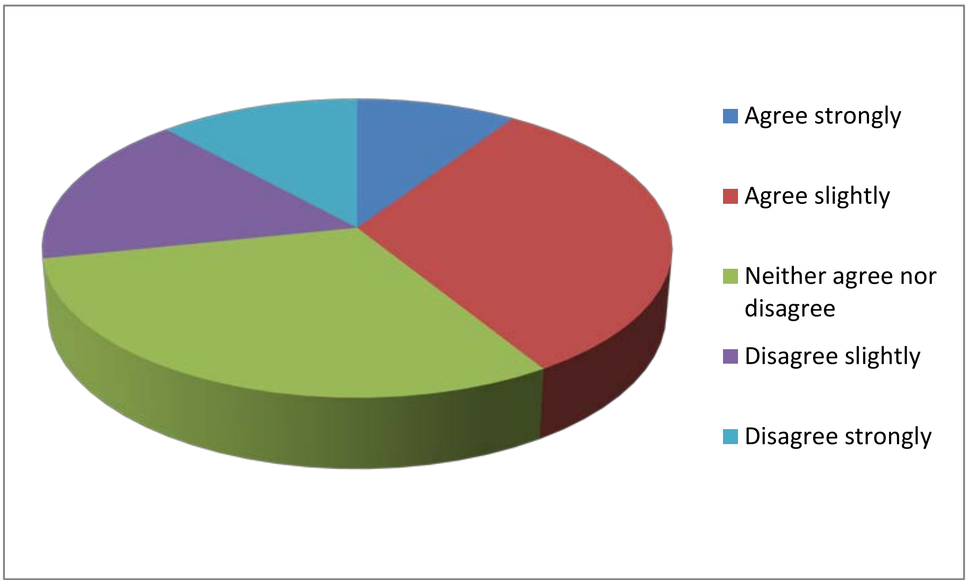


FIGURE 4-12: ABILITY TO PURSUE OPEN INNOVATION WITHOUT ASSISTANCE

4.5 Survey Implications and Discussion

The open innovation survey under SMEs provided a view on the appetite for and use of open innovation within the South African context. It explored SME innovation activity and the use and adoption of open innovation methods. The study showed that SMEs consider innovation to be important for business success and that most SMEs are active in coming up with new innovations for the market or to launch internally in their organisations. Innovation is however not a very mature practice in most SMEs with only a small percentage of organisations having a formal innovation process or dedicated innovation budget. Notwithstanding this, almost 90 percent of SMEs indicated that they had produced at least one innovation in the 12 months prior to the survey, with some claiming to have launched more than 10 in that period.

Adoption of open innovation as a structured innovation method is still relatively new in South Africa (as with most countries in the world). Feedback received from participants indicated that even though they used open innovation approaches in their organisations, that they did not know that what they were doing was in fact open innovation. They often used these approaches because it made sense in their business context, rather than making a decisive business decision to adopt ‘open innovation’ as an innovation strategy. It was therefore less about labelling an approach and more about the outcome that could be achieved through that approach. There is therefore a potential opportunity in making SMEs aware of how open innovation works as a holistic innovation approach and how more value could be obtained if open innovation were to be implemented as a coherent set of actions, rather than just ad hoc efforts.

Customers and suppliers were selected as the preferred innovation partners, which makes sense when considering that collaboration and customer immersion were selected as the top open innovation approaches in the survey. These partners and innovation approaches are closest within the SME's network and would therefore reduce the effort and resource requirement to manage the innovation initiatives using these options (Van de Vrande et al., 2009). When the SME selects options outside of their immediate network where current relationships do not already exist, then it would require more effort from the SME to establish and maintain that relationship. Only about 28 percent of participants indicated that their organisations had more than ten employees, so for most SMEs it would put strain on their absorptive capacity to build extended relationships outside of their established network (Spithoven, 2011).

It must be recognised that this study was conducted under SMEs that formed part of business forums on LinkedIn and could therefore include a bias towards openness in their organisations, given their involvement in social networks that require a degree of open engagement. It might therefore not provide a view representative of all SMEs in South Africa. It still, however, provides a good view of this subset of SMEs that may have an increased chance of adopting open innovation as a formal innovation approach, making the development of such an approach most relevant to them.

4.6 Chapter Conclusion

This chapter set out to answer the first secondary research question and meet the associated objective being:

SRQ2: What is the appetite for and use of open innovation in SMEs within South Africa?

SRO2: To determine the appetite for and use of open innovation in South African SMEs.

The survey showed that there is a genuine interest in using open innovation, with more than 70 percent of non-IT and more than 60 percent of IT participants agreeing to some extend that open innovation is a positive method of innovation and with 60 percent indicating that they are involved in some form of open innovation activities in their organisations. The lack in knowledge on the topic may however be a real deterrent in wider adoption with only about 40 percent of respondents considering their knowledge of open innovation to be sufficient for open innovation adoption and implementation without assistance. Initiatives are typically ad hoc in nature, with no formal or structured innovation approach being followed in most organisations (only 27 percent indicating a formal innovation process). There is therefore a need for a structured approach that SMEs can adopt to implement and execute open innovation and a need for assistance with the implementation of such an approach.

This chapter has therefore answered SRQ2 through the associated survey, showing that there is a healthy appetite for using open innovation and that open innovation is being adopted by SMEs. It also further substantiates the need to develop an open innovation approach for SMEs as part of this study.

Chapter 5: Design Requirements

The survey results described in the previous chapter confirmed that there is an appetite for the use of open innovation by South African SMEs. Application of open innovation tended to be ad hoc in nature, with limited structure in the form of dedicated innovation processes or funding methods being used. There was also a lack of confidence in their ability to implement open innovation on their own, due to a deficiency of in-depth knowledge on the subject.

The survey showed that there is a requirement for the development of an open innovation approach that can be used by SMEs for their open innovation initiatives. The approach could provide reference to tools to consider and guide them on the steps and considerations when using open innovation to develop new products or services for their organisations. First, what is needed to develop such an open innovation approach is to develop the requirements. This chapter will therefore set out the requirements for such an approach, based on the output of the survey and other literature.

Performing step 2 of the research methodology set out in chapter 3, the requirements for the open innovation approach are defined. The requirements helped to guide the development of the approach and are derived from the prior literature and from the survey which was conducted in step 1 of the research methodology as detailed in chapter 4.

The secondary research question and objective used during this step are:

SRQ3: What are the design requirements for an open innovation approach for SMEs?

SRO3: To determine design requirements for an open innovation approach for SMEs.

The design requirements defined in this chapter were used as criteria for the requirements adherence matrix in step 4 of the research methodology during demonstration and evaluation. The design requirements were first published as an article in the South African Journal of Industrial Engineering (Krause & Schutte, 2015).

Following the design sciences method for developing an open innovation approach, there was a need to first clearly define the design requirements for the design. The design requirements will set out expectation considerations for the design artefact – in this case the open innovation approach. The design requirements basically set out the criteria that the design must adhere to. If we use a car as a comparison, then the design requirements for that car may be that it should be able to drive on-road and off-road, must have all-wheel drive capability, cannot exceed a prescribed weight, should be easy to drive, etc.

The design requirements for the open innovation approach were derived from analysing open innovation theory and considering findings from the open innovation survey from chapter 4. Furthermore, the design requirements also incorporated guidelines from innovation protocol development as described in the literature (Weber, 2011). Protocols found within the science and medical fields provide guidelines, consensus statements, procedures or criteria for conducting experiments or treating patients (Weber, 2011). They provide the user of the protocol with information on 'best practice' and accepted standards on a subject and influence decision-making. Although providing clear guidelines, "good protocol leaves its user the necessary freedom to act upon encountered results of its steps; it is not intended to provide strict instructions" (Weber, 2011). Similarly, design propositions (the approach taken in this study) can be in the form of guiding principles or technological rules (Denyer et al., 2008; Tan, 2010).

5.1 Requirements Categories

Developing requirements for any type of design and/or development project is a critical first step in achieving an appropriate artefact at the end of the process. This concept of understanding and specifying requirements upfront and then using those requirements to validate adherence at the end of the development process is a well-used approach in disciplines such as systems engineering (Kossiakoff et al, 2011) and software development (Royce, 1970).

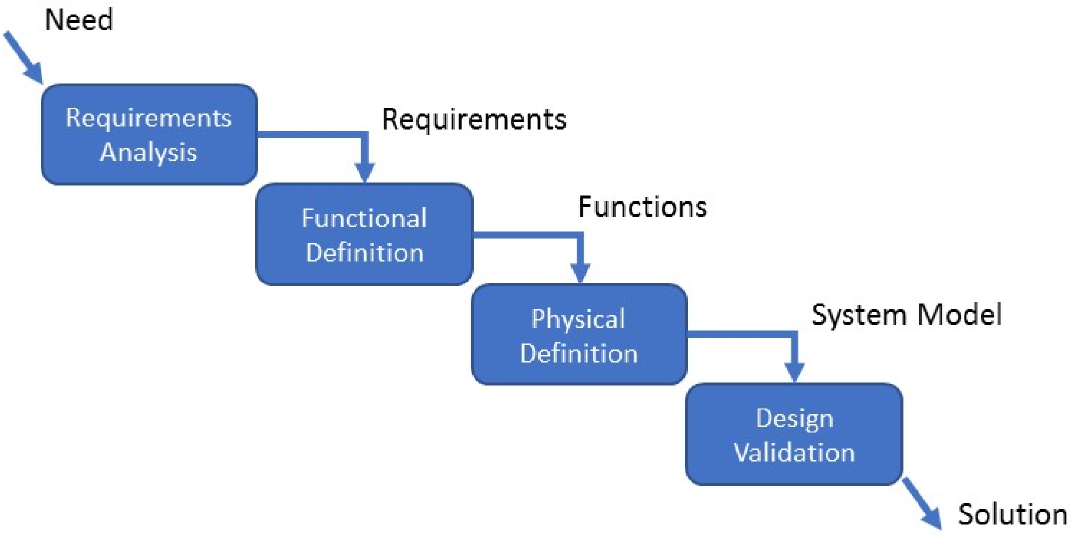


FIGURE 5-1: SYSTEMS ENGINEERING APPROACH (ADAPTED FROM KOSSIAKOF ET AL, 2011)

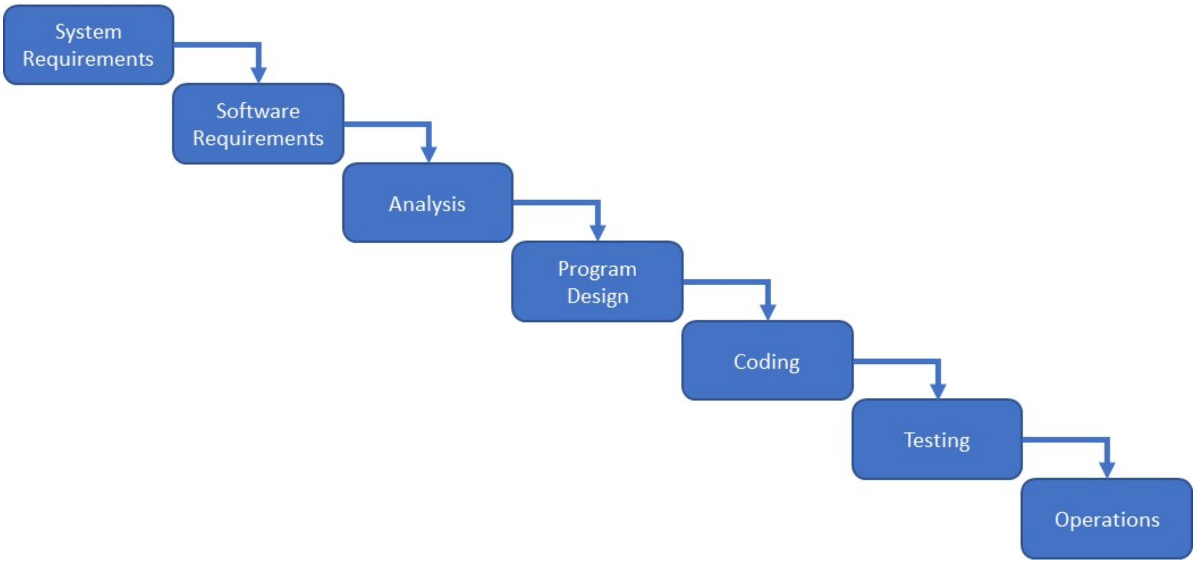


FIGURE 5-2: WATERFALL APPROACH IN SOFTWARE ENGINEERING (ADAPTED FROM ROYCE, 1970)

Chapter 2 positioned the design sciences research method that also makes use of requirements definitions at the beginning of the design process. Brockmöller (2008) and Weber (2011), building on the work of Van Aaken et al. (2007), provided guidance on developing design requirements for an approach when following a design sciences research method. Following these guidelines, the design requirements have been divided into five categories with every category representing a different functional specification of the design (Brockmöller, 2008):

- User requirements: specific requirements from the viewpoint of the user (in this context the SME, employee of the organisation or a third party implementing and utilising the approach). Requirements regarding the use of the design.
- Functional requirements: the core of the specification and in the form of performance or result demands on the protocol to be designed. What the approach is designed to do.
- Boundary conditions: requirements or rules that must be met unconditionally and may not be altered, e.g. legislation, ethical habits and code of conduct.
- Design restrictions: about the preferred solution space. Limits of the design, exclusions, and elements not covered in the design.
- Attention points: those specifications that are relevant to the design and should be noted, but that are not requirements that must be met, and are also not design restrictions. Yet, they are important considerations, almost warning points for the designer to consider when designing.

5.2 Design Requirements for an Open Innovation Approach

Design requirements for each requirement category are provided in tabular form with relevant motivation for each requirement. Motivations were used to substantiate the inclusion of the requirements, using literature and the outcome of the South African open innovation study as basis. Requirements reference indicators are noted by the following notation *<Requirement#>*, using the reference key below.

- User requirements = U
- Functional requirements = F
- Design restrictions = R
- Attention points = A
- Boundary conditions = B

5.2.1 User Requirements

Chapter 1 introduced the problem statement to this research and provided background on the context of this study. It stated the importance that innovation could play in the success and growth of SMEs, especially in an emerging economy such as South Africa's. The introduction made it clear that this research would have a focus on South Africa and applying innovation within the South African context. Although it may be true that innovation concepts are generic enough to be 'country agnostic', it was still made clear that any specific South African nuances and contextual considerations should be considered. It was mentioned, for instance, that SMEs are classified as organisations with 1 to 200 employees. The open innovation survey from chapter 4 was also conducted using South African SMEs.

The survey showed that more than 70 percent of the respondents had between 1 and 10 employees. This adds a significant resource constraint to the use of an open innovation approach and any recommendations made in the application of tools and techniques. The number of employees therefore becomes a challenge for SMEs adopting innovation (Brunswicker, 2009), also impacting its absorptive capacity in the organisation (Newey, 2010).

The literature provided some generic user requirements to consider when developing design propositions for use in the design of a protocol or approach.

- One should be able to use the approach in a continuous way and work through it in a systematic way (Weber, 2011);

- The approach should provide management with enough guidance to implement the tools and techniques or steps recommended within the organisation. It is usually accepted that the user will have some sort of experience or expertise within the field of application or the environment that it is being applied in (Weber, 2011; Tan, 2010);
- The approach should be user-friendly and easy to adapt to and adopt into the specific organisational circumstances (Van Aken et al., 2008; Tan, 2010);
- It needs to provide for some flexibility in its application (Van Aken et al., 2008; Tan, 2010; Weber, 2011).
- The approach should be understandable, providing clear definitions and explanations (Tan, 2010; Weber, 2011).

It was important that the approach could be implemented without the need for an external expert. The innovation survey from chapter 4 stated the need for more knowledge in the implementation of open innovation, but should be facilitated through the approach and not necessarily through an external third party. The resource and financial constraints that most SMEs face will make it difficult to always be reliant on external parties for innovation support (Brunswicker, 2009).

Applying business management methods to the discipline of open innovation in SMEs as discussed in chapter 1, required organisations to move from an ad hoc, low maturity environment of innovation, to a more sustainable and repeated use of open innovation. The open innovation survey showed a high percentage of SMEs were still falling within the ad hoc innovation category, which needed to be moved towards a more repeatable capability (Carpinetti et al., 2007; Weber 2011).

The following user requirements (requirements regarding the use of the approach) are proposed:

TABLE 5-1: USER REQUIREMENTS

U1	*Requirement:* The approach should consider the context of the South African SME, specifically its constraints, such as number of employees and access to resources.
	Motivation: The study on open innovation highlighted in chapter 4 was conducted among South African SMEs specifically. The conclusions and recommendations derived from the study, although possibly applicable to SMEs in other parts of the world, are therefore specific to South Africa. The design requirements for the approach are therefore intended to be focused on South Africa, and should consider the country's specific SME context. The size classification for SMEs in South Africa, for instance, is different from that in other countries such as the USA. This will have an impact on factors such as the availability of resources to be allocated to open innovation tasks, etc.
U2	*Requirement:* The user should be allowed flexibility to apply their own discretion when using the approach.
	Motivation: The approach should not be prescriptive but rather descriptive in nature. There should be allowance for adaptability and customisation to suit the specific circumstances of the specific organisation applying the approach (Weber, 2011). Design requirements are not set rules to follow, but should form guidelines that the user can adopt, given their specific organisational requirements.
U3	*Requirement:* The approach should be user-friendly – i.e. easy to adopt, understandable, and easy to use.
	Motivation: Weber (2011) suggests that an approach should be user-friendly and not require specialised resources to implement it. Resource constraints within SMEs to execute the innovation process should therefore be considered. As mentioned in the survey, for example, almost 72 percent of South African

	SMEs have ten or fewer employees. Specialist innovation resources are therefore highly unlikely. With a high percentage of SMEs also indicating that they are not comfortable implementing open innovation into their organisations on their own, makes developing a simplistic approach for these organisations important.
U4	*Requirement:* The approach should be considered as a management aid for implementing open innovation within SMEs.
	Motivation: 77 percent of the open innovation survey answers were provided by owners of the organisations, and 15 percent were from managers. The approach being designed should therefore be accessible to the management team of the SME, which often play dual roles of management and execution due to the low number of resources in the organisation.
U5	*Requirement:* The approach should support repeated and continued use.
	Motivation: The intent of the open innovation approach is not to be a once-off application, but to be used as an embedded management approach towards innovation on a continuous basis. It should assist the SME to move from an ad hoc event (as identified in the survey for many SMEs) to a repeatable management practice within the organisation, supporting continuous innovation (Carpinetti et al., 2007).
U6	*Requirement:* The approach should provide clear definitions and explanations.
	Motivation: To simplify use and improve adoption of the approach, it is recommended that the approach provide clear definitions and explanations on how to implement and use the approach (Tan 2010; Weber 2011). This should not become a barrier to use. Linking to User Requirement U3, the approach must be implementable without the need of extensive specialist intervention, providing clear terms and guidance relating to open innovation.

5.2.2 Functional Requirements

The open innovation survey discussed in chapter 4 indicated that organisations consider innovation to be important for success in their respective industries. SMEs recognised the need to innovate to stay relevant in their markets. However, only 17.6 percent of survey respondents agreed strongly that they considered themselves knowledgeable on the topic of open innovation. This highlighted the need to educate SMEs more on the subject of open innovation and to formalise this concept more as an approach to innovation.

Gassmann & Enkel (2004) proposed three different orientations or process flows for open innovation in an organisation.

- Outside-in process: Incorporating knowledge or technology from outside of the organisation into its innovation processes.
- Inside-out: The external exploitation of ideas in different markets, selling IP and multiplying technology by channelling ideas to the external environment.
- Coupled process: Combining outside-in and inside-out processes together, either throughout or at selected stages of the innovation process, forming alliances in a network model to deliver innovation to the market.

Chesbrough & Eichenholz (2013) suggested making use of outside-in open innovation to gain access to new external inputs and contributions to stimulate growth. Licensing underutilised IP to external organisations for utilisation within other business models or spin-off ventures within the inside-out open innovation process can also add additional value to the organisation.

In addition to just the process required for open innovation, consideration needs to be given to the enabling organisation factors required to implement open innovation. Considering the A.T. Kearney House of Innovation model (Innovation Management, 2012), it proposed elements such as the innovation strategy to provide a clear vision and strategic focus on innovation, the organisation culture and structure with clear roles and responsibilities and the efficient management of IP. The Fugle innovation model shown in Figure 5-3 presented a similar view (Du Preez & Louw, 2008). It provided a full end-to-end innovation process from idea generation to commercialisation with linkages to external environments (supporting open innovation), but also considered strategy, people and culture, information and knowledge, and organisational structure and processes as enabling factors.

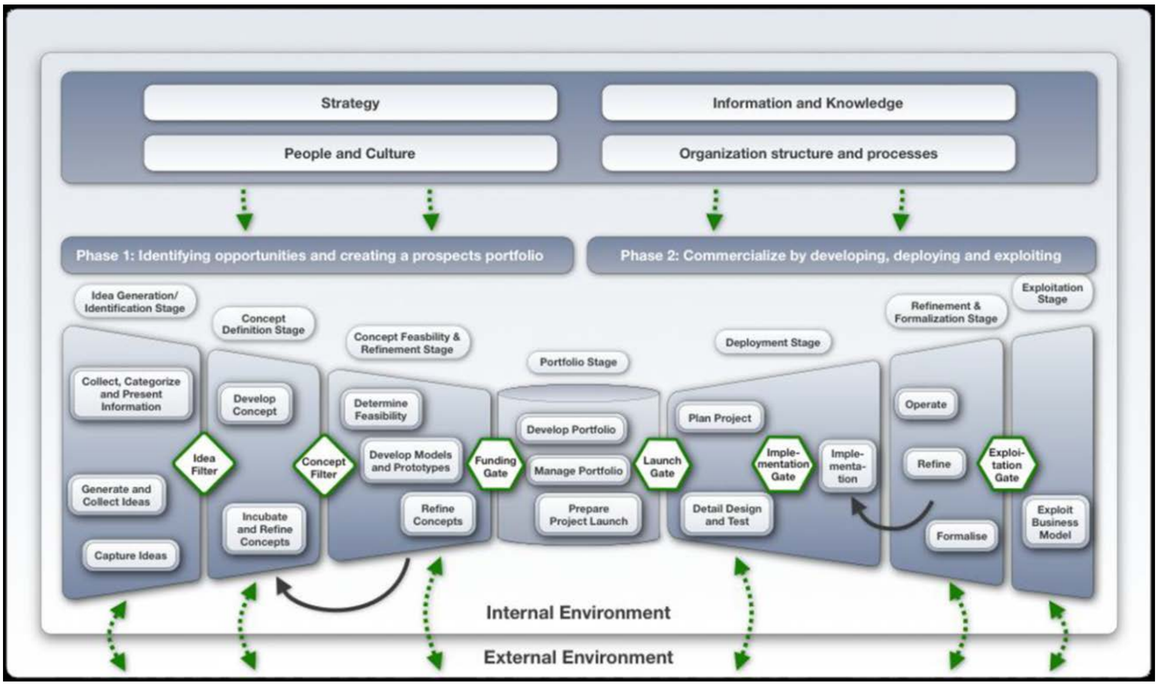


FIGURE 5-3: FUGLE MODEL (SOURCE: DU PREEZ AND LOUW, 2008)

It was pointed out earlier in the chapter that SMEs face various constraints when implementing open innovation. Limited financial resources for innovation, limited size workforce (often without specific innovation skills), and less systematic management capability all contribute to the challenges SMEs face to adopt open innovation. “There is a need, therefore, for methods that can help SMEs overcome these barriers to the successful implementation of … open innovation” (Bianchi et al., 2010). These methods should not overburden SMEs with their use, but ways to simplify these methods should be sought for better adoption (Turner et al., 2012).

Innovation can take on many forms in different organisations, based on their innovation and business strategies. The survey in chapter 4 provided insight into three dimensions where innovation may differ between organisations. Firstly, the area of innovation can be different. The survey showed a strong tendency towards product innovation, but also indicated interest in business model, strategy and process innovation for instance.

Secondly, the type of open innovation method could also be different, depending on the organisation’s decision to apply outside-in, inside-out or coupled open innovation. The survey showed a dominant interest in making use of collaboration and customer immersion for open innovation.

The third dimension looked at innovation partners to perform open innovation with. From the survey, the two preferred innovation partners were indicated as customers and suppliers, although options such as government, development companies or competitor companies could also be chosen. The open innovation approach should therefore be flexible enough to cater for these various options and not be too restrictive in its design.

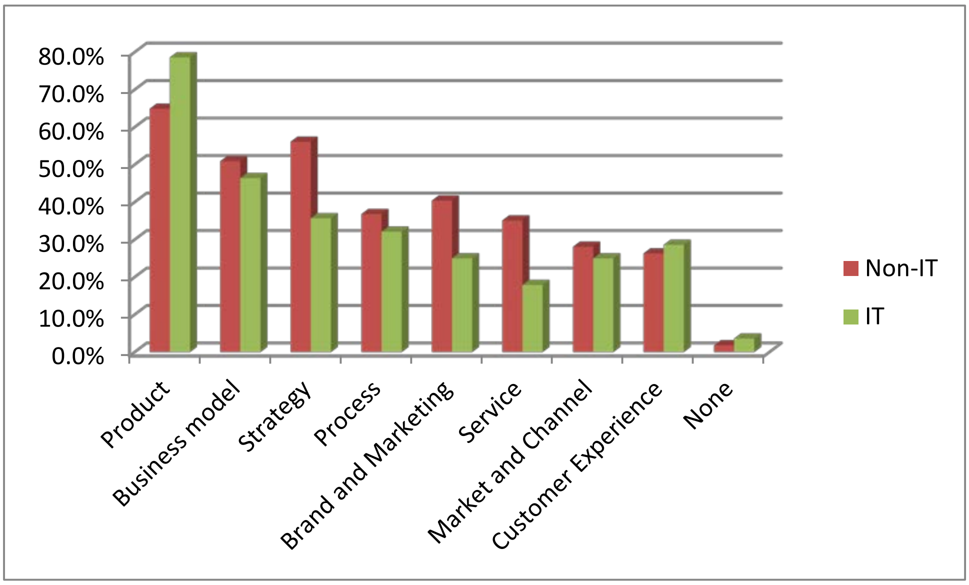


FIGURE 5-4: INNOVATION TYPE

Another important consideration is the differences between industries that will use the open innovation approach. The survey from chapter 4 showed some differences in the responses from IT and non-IT organisations in their open innovation preferences and innovation practices. The approach should be able to accommodate SMEs in various industries such as manufacturing or services. There was also an indication in the survey suggesting that organisations were at different stages of their open innovation journey and in the maturity of their innovation practices (such as dedicated innovation processes and funding). These can have an influence on the type of actions that can be recommended for adoption and applied within organisations.

It needs also to be acknowledged that various levels of openness can exist within organisations. In chapter 3 the concept of openness levels was introduced and it was discussed that organisations can differ in their degree of openness based on their open innovation strategy, even between stages of the innovation process. An open innovation approach needs to accommodate decisions on when and where to open up the innovation process and about the way this openness will be managed. Figure 5-5 shows an example of how the level of openness may appear for an organisation, mapped against its innovation life cycle.

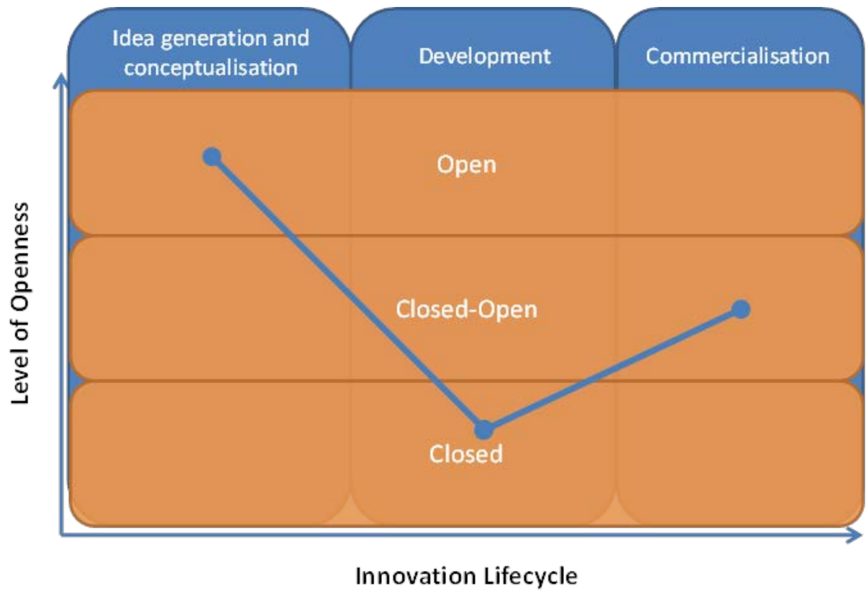


FIGURE 5-5: LEVEL OF OPENNESS

In chapter 3 it was stated that "A design proposition can be seen as offering a general template for the creation of solutions for a particular class of field problems" (Denyer et al., 2008). Design propositions using CIMO-logic would normally not be stand-alone artefacts, but would contain further information expanding on the proposition or providing deeper insight on how the design proposition was derived. The approach should therefore provide information on the theory explored to derive the design propositions, giving guidance and suggestions on tools, techniques or best practice applications.

The main research objective for this study is defined as: *To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.* The research objective requires three focus areas to be satisfied – implementation, execution and improvement. These should be added as a functional requirement to make sure that those three areas are included in the design of the approach.

The following functional requirements (what the approach should be designed to do related to performance) are proposed for the open innovation approach.

TABLE 5-2: FUNCTIONAL REQUIREMENTS

F1	*Requirement:* The approach should lead to improved open innovation capability and execution within SMEs.
	Motivation: The main goal of designing an open innovation approach for SMEs would be to improve the adoption and execution of open innovation in these organisations. This requirement was clear from the open innovation survey, as mentioned in chapter 4. SMEs need assistance with their open innovation efforts and a more formal approach compared to what is often a more ad hoc approach.
F2	*Requirement:* The approach should cover the end-to-end life cycle of innovation, from ideation to commercialisation, for both inbound and outbound open innovation.
	Motivation: Open innovation can be used during any part of the innovation process (Chesbrough & Eichenholz, 2013; Gassmann & Enkel, 2004), and the approach should cater for this requirement. The approach should be able to accommodate the requirement to either bring in IP and technology from

	outside of the organisation (inbound) or take IP or technology outside of the organisation for further development and use (outbound). There may also be a need to have a combination of the two directional flows. This was also discussed in chapter 3.
F3	*Requirement:* The approach should cover not only the innovation process but also the organisational factors that enable innovation.
	Motivation: A comprehensive approach will consider the organisational factors that enable innovation within the SME, since innovation is impacted by more than just the innovation process. This is made clear in innovation models such as the A.T. Kearney House of Innovation (Innovation Management, 2012) and the Fugle innovation model (Du Preez & Louw, 2008). Innovation is more than just the process where the innovation takes place. An organisation should also consider the supporting factors that allow the organisation to innovate.
F4	*Requirement:* The approach should provide business management method principles that can be applied within open innovation.
	Motivation: An open innovation approach for SMEs should consider the limitations and challenges SMEs face compared to larger organisations (such as limited resources and organisational maturity) (Bianchi et al., 2010; Brunswicker, 2009), yet use management methods that are applicable to SMEs to enhance the impact and effectiveness of the approach. The survey in chapter 4 showed that only 27 percent of respondent organisations had a formal innovation process; therefore, management methods will enhance the business rigour with which open innovation is applied within SMEs. The idea is not to overburden SMEs with management overheads, but rather to introduce learnings that can benefit SMEs to better manage the innovation process, still within their context.
F5	*Requirement:* The approach should include multiple open innovation options to be pursued, based on the innovation requirements and strategy of the SME.
	Motivation: SMEs must be able to use the approach based on their own innovation strategy, which will differ between organisations (Innovation Management, 2012; (Du Preez & Louw, 2008). The survey from chapter 4 also indicated various innovation preferences that can be pursued. The user should have the flexibility to select the most appropriate approach for the organisation, with the approach being able to accommodate the selection.
F6	*Requirement:* The intent of the approach should be for organisations that want to apply open innovation, although it should be recognised that there can be varied degrees of openness.
	Motivation: Levels of openness may vary in organisations, as described in chapter 3. Organisations may also choose to be more open in certain parts of the innovation process, based on its strategy. Having an approach that can be used by organisations of various levels of openness, makes it more generally applicable and will also mean that the organisation can adapt the approach to suit changes in its strategy if required.
F7	*Requirement:* The approach should provide recommendations on the type of open innovation selection, to increase the chances of open innovation success.
	Motivation: The open innovation survey study showed that SMEs are planning to use various open innovation types for the development of new innovations. An open innovation approach should therefore be able to cater for these various open innovation types (Figure 5-4), since their application may be different.
F8	*Requirement:* The approach should be useful for various sectors.
	Motivation: SMEs that use the approach will no doubt have various levels of business and innovation maturity and will be from various business sectors, as was also clear from the survey results presented in chapter 4.

F9	*Requirement:* The approach should include or recommend tools and aids to assist with executing open innovation.
	Motivation: Although not meant to be an exhaustive manual, the open innovation approach should provide tools and techniques to accommodate these varied organisations (Weber, M. 2011), and assist users to implement a structured open innovation process. The approach should provide options for the user to reference and select from when making decisions regarding the various elements of the approach, recognising that users may have varied levels of knowledge about open innovation.
F10	*Requirement:* The approach should consider the innovation maturity level of the organisation.
	Motivation: The survey study in chapter 4 highlighted the varied degrees of innovation maturity across the surveyed organisations, with only 27 percent of organisations having a formal innovation process, and 40 percent being slightly or strongly comfortable with pursuing open innovation themselves. The survey also highlighted the different stages of open innovation use in these organisations with some organisations being well ahead in their open innovation journey, while others have not started yet.
F11	*Requirement:* The approach should cover the *implementation*, *execution* and *improvement* of open innovation.
	Motivation: The main research objective is to develop an approach for SMEs to implement, execute and improve open innovation in their organisations. This requires three distinct focus areas to be included in the approach covering these aspects of the design. The survey from chapter 4 showed that SMEs are in various stages of their open innovation journeys. Some are only starting out and more likely in the implementation stages of their programmes, while others are well along their journey and executing their programmes and more likely starting to think about how to improve their open innovation capabilities.

5.2.3 Design Restrictions and Attention Points

Design restrictions should provide limits to the design. If restrictions are too severe, they could impact on the usefulness of the approach by making it too narrow. If the design is too broad, however, it could have the reverse effect of becoming overly generic and losing its applicability.

Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation (Hevner et al., 2004). As mentioned earlier in this chapter, it should aid in a comprehensive learning process and might take on the form of reports, articles, manuals or templates (Denyer et al., 2008). Design propositions are often constructed at a higher level of abstraction than the original material on which they are based, providing a more generic principle-based proposition (Tan, 2010, Strauss 1998). "Concepts are developed through constant comparison, interpretation, and abstraction" (Peters, 2014). Using a process of abstraction within the design sciences approach as mentioned in chapter 3, literature can be selected based on the criterion 'fit for purpose' as per Boaz and Ashby (2003) based on whether the literature retrieved adds anything new to understanding the phenomenon (Denyer et al., 2008; Tan, 2010). This approach helps to contain the information presented to be relevant, yet it is not overwhelming or laborious.

The focus of this study is the use of open innovation within small and medium-sized organisations. In chapter 1 it was stated that research into open innovation in SMEs is lagging behind research concerning larger organisations and requires attention to understand the phenomenon in the context of SMEs (Bianchi et al., 2010; Chesbrough, 2010). Types or modes of open innovation such as IP in-licensing, customer co-creation, or crowdsourcing can be used in large organisations (Chesbrough & Brunswicker, 2013) or SMEs (as seen in chapter 4). Brunswicker and Vanhaverbeke (2011) found five different external search methods used by SMEs and determined the impact of each method when employed by SMEs. Understanding such nuances can be valuable for SMEs implementing open innovation tools and techniques, more often used in larger organisations. In a study by Spithoven et al. (2012) they concluded that "different dimensions of OI practices (search strategies, external R&D, research collaboration and protection mechanisms) affect the innovative performance of SMEs". Their recommendation was therefore that "OI in SMEs should be framed differently than in large companies".

Van de Vrande et al. (2008) proposed that there is a difference in the adaption to open innovation between larger and smaller SMEs. They suggested that larger SMEs adapt "more quickly and in a more structured and professionalized way to open innovation than smaller ones" (Van de Vrande et al., 2008). Their research also showed that many factors can be barriers to open innovation for SMEs, leading to varied degrees of implementation success. These may include organisational and cultural differences when cooperating with other partners, administrative burdens, financing and knowledge transfer problems.

"Protecting intellectual property and controlling the use of their inventions is key to the strategy of many firms. At the same time, in order to be successful in open collaborative innovation, firms need to share their knowledge with others" Bogers et al., 2012). Managing IP can be a daunting – and often expensive – task for an organisation, especially SMEs with limited resources. IP management is a very specialised field. The laws applicable to IP rights, although similar across the world, may have specific nuances in interpretation and application depending on the country under whose jurisdiction they are being used in. It is therefore highly recommended that sound legal advice is obtained when making decisions on IP management when practising open innovation.

The South African National Small Business Act (1996) classified the size of SMEs to be less than 200[3] employees for medium-sized organisations and less than 50 for small organisations. This causes variability as to how organisations are structured for operations, due to the number of employees to fulfil tasks or the capital and other resources available to invest in new products and services. SMEs also often specialise their business into narrow fields with niche strategies and operations (Chesbrough, 2010) that can introduce diverse requirements for innovation.

The literature review in chapter 3 highlighted that open innovation research, especially by SMEs, is still limited, albeit growing in volume (Chesbrough, 2010; Bianchi et. al. 2010). Research in larger organisations has been more popular, with a focus slowly shifting towards SMEs, in line with the growing interest and involvement of these organisations in open innovation (Van de Vrande et al., 2008; Gassmann et al., 2010). However, it remains an area of research that still requires more focus to grow the literature base in the understanding of the impact and use of open innovation within SMEs.

The following design restrictions and attention points are proposed:

TABLE 5-3: DESIGN REQUIREMENTS AND ATTENTION POINTS

R1	*Requirement:* The approach is not meant to include an exhaustive set of tools and methods available for open innovation, but should be comprehensive enough to provide sufficient relevant options for SMEs.
	Motivation: No single method can be all things for all situations. The open innovation method should be comprehensive, but it is not expected to contain every possible open innovation tool in existence. Having too broad a coverage could make the approach cumbersome and clumsy, reducing its effectiveness and increasing resistance to adopting it within the organisation (Weber, 2011; Van Aken

[3] With the exception of less than 100 for the agriculture sector

	et al., 2007). A balance should be found between being sufficiently comprehensive while also being easy to use (user requirement U3).
R2	*Requirement:* The approach is intended for SMEs, even though some principles, tools, and methods may be applicable to larger organisations.
	Motivation: As previously stated, the approach should be for the intended use of SMEs. Some of its tools may be applicable to larger organisations, but it should remain focused on being relevant to SMEs. Both large organisations and SMEs can, for instance, use a method such as IP in-licensing; but due to the nature of the organisations, how they do this will be different (Brunswicker, 2009; Chesbrough & Brunswicker, 2013). The approach should where appropriate, highlight particular points where the application of a method may differ between the use in large organisations compared to SMEs.
R3	*Requirement:* The approach is not a legal or legislative guide, and input required for such items (e.g., IP management) should be obtained from specialists within those fields.
	Motivation: IP management is an important factor to consider in open innovation (Bogers et al., 2012), even though participants in the survey from chapter 4 gave this issue low attention. Legal and legislative interpretations can be complex, however, depending on the situation of application. It is therefore recommended that the approach cover IP management and other relevant legal elements as a consideration, but not aim to provide legal interpretations or advice (Weber, 2011).
R4	*Requirement:* The approach does not guarantee open innovation success due to the multitude of factors that could influence such an outcome. However, it does provide principles based on theory and practice to increase chances of success when applied.
	Motivation: It would be naïve to think that the innovation approach will guarantee open innovation success in an organisation. Open innovation is challenging to implement, and multiple other factors could impact on the success of open innovation and/or business success (Chesbrough & Brunswicker, 2013; Van de Vrande et al., 2008). The approach should provide a guide based on the best practice principles for implementing open innovation in organisations, in order to improve the chances of success, compared to when innovating without guidance in an ad hoc manner.
A1	*Requirement:* Some items to be included in the approach will be discretionary and dependent on factors inherent to the organisation, such as its set-up, size, and strategy. Decisions about how or whether to apply these will therefore differ between organisations. Examples of these include IP agreements and technology use.
	Motivation: Functional requirements 4, 5, and 8, as well as design restriction 3, mention the variability within SMEs. Organisations have different organisational elements that can impact on innovation (such as a formal innovation process, organisational strategy, available resources, and market dominance) and will therefore require discretion from management on how the innovation approach will be implemented within the organisation. The approach should not form a list of rules to follow from beginning to end, but should rather be seen as a list of options to consider for selection and implementation.
A2	*Requirement:* It is acknowledged that open innovation in SMEs as a formal discipline is still very new, and that the approach to be developed will be based on emerging findings from SMEs and larger organisations. The approach should be seen as a reflection of early best practice within an evolving field of knowledge.
	Motivation: Academic research on open innovation, and specifically open innovation within SMEs, is still relatively undeveloped (Chesbrough, 2010; Bianchi et al., 2010; Gassmann et al., 2010). The open innovation approach being designed needs, therefore, to draw upon a small pool of available expert content, and would also need to deduce findings from research done within large organisations, which is more readily available than research into open innovation in SMEs. The approach would add to this emerging body of knowledge on open innovation.

5.2.4 Boundary Conditions

The boundary conditions provide rules of use. They suggest the conditions of use to be followed by the user of the approach, given that the approach will be applied outside of the supervision of the approach designer. The boundary conditions provide reasonable assumptions on how the approach can be expected to be used within an organisational context (Brockmöller, 2008; Weber, 2011).

Organisations are governed by the legislation prescribed by their country of operation. Legislation will determine aspects such as the requirements to qualify as a specific business entity (such as number of employees and turnover), tax frameworks to follow, applicable labour law etc. (National Small Business Act, 1996). Organisations applying the approach would therefore be expected to comply with these regulatory, legal and governance requirements.

When making use of open innovation as a chosen innovation strategy, there will be a natural flow of information, knowledge, technology and other intellectual and physical assets flowing between innovation parties (Boger et al., 2012; Chesbrough, 2003). Protecting the interests of all parties within the process and accumulating appropriate value to all is vital for a successful and durable open innovation relationship (Chesbrough, 2003).

The following boundary conditions are proposed.

TABLE 5-4: BOUNDARY CONDITIONS

B1	*Requirement:* The approach should be used in a legal and ethical way by the SME.
	Motivation: The authors cannot control the use and possible exploitation of the open innovation approach in practice. It is therefore important to define the reasonably assumed boundaries of application (Weber, 2011). It is assumed, for instance, that the open innovation approach will be applied in a legal and ethical way, adhering to corporate governance and other relevant restrictions and legislation.
B2	*Requirement:* The approach should not be used to negatively exploit other parties involved in the open innovation process.
	Motivation: Due to the nature of open innovation, parties involved in the sharing of ideas, knowledge, and technology can easily be exploited by interacting parties (Bogers et al., 2012). Especially when there is a power imbalance, the smaller of the parties could be at a disadvantage (Brunswicker, 2009; Van de Vrande et al., 2008).
B3	*Requirement:* The open innovation approach should promote value for all parties involved and assist in establishing trust.
	Motivation: The intent of the open innovation approach should be to obtain mutual appropriate value for all parties involved in the innovation process (Chesbrough, 2003; Bogers et al., 2012).

5.3 Chapter Conclusion

The design requirements proposed in this chapter were used as input into the development of the open innovation approach for SMEs, discussed in the subsequent chapters. The design requirements guided the development of the approach, setting out criteria to be met from functional and user perspectives, including restrictions to the design and other points of consideration.

Following design science principles from the literature (Weber, 2011; Brockmöller, 2008; Van Aken et al., 2007) and guided by the open innovation survey results from chapter 4 and other literature, 26 design requirements were developed for the approach. Defining the design requirements therefore addressed the second secondary research question and objective as set out in chapter 3:

SRQ3: What are the design requirements for an open innovation approach for SMEs?

SRO3: To determine design requirements for an open innovation approach for SMEs.

In chapter 9, these design requirements will further be used to validate the open innovation approach. The stated requirements were tested against the approach result to make sure that all requirements had been considered and adhered to. The requirements therefore played an important part in the methodological soundness of the study within the context of the design sciences method being followed.

Chapter 6: Framework for an Open Innovation Approach

This chapter introduces the development of a framework for the open innovation approach. The framework follows from the design requirements defined in chapter 5. The framework development forms the first design iteration according to the design sciences approach defined in chapter 2 of this dissertation, serving as boundaries to the open innovation approach. It is the first step in our constructivist approach towards developing open innovation approach design artefact. The development of the framework was driven by the following secondary question and objective:

SRQ4: What framework can be developed for an open innovation approach for SMEs?

SRO4: To develop a framework for an open innovation approach for SMEs.

The framework was derived through a process of abstraction and synthesis from models and frameworks in the literature. Three literature review focus areas were examined, being innovation frameworks (addressing how to perform innovation), implementation frameworks (addressing how to implement innovation) and improvement models (addressing how to improve innovation). This aligned to the main research objective of this study to *develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations*.

Framework elements were abstracted from these literature focus areas and used to construct an open innovation framework. Elements for the framework were derived based on the identification of commonly occurring elements in the reviewed frameworks and models, suggesting a requirement for inclusion. It also assessed references to best practice within the domains of innovation and implementation frameworks. According to Chesbrough and Brunswicker (2013) for instance, “a formal approach implies that firms have a clearly documented strategy for open innovation, use written and standardised processes for implementing open innovation, document their routines, and rely on different kinds of metrics for measuring and reviewing the impact of open innovation”.

The design process of the framework saw two different levels of abstraction or detail emerge. First, an architecture was created, based on the life cycle phases that emerged from the literature. Secondly, the framework elements were formed from more detailed innovation steps. This process continues in chapter 7, when the design propositions are developed within the boundaries of the framework from a detailed evaluation of open innovation and business management methods. To use a very simple analogy, the architecture from the life cycle phases can be compared to the design of a house. The materials to build the house (bricks, windows) is the framework – in our case the innovation steps within the architecture. The detailed design propositions to be developed in chapter 7 become the furniture within the house and form part of the toolset within the open innovation approach.

6.1 Theoretical Frameworks and Models Review Requirements

Chapter 5 defined three functional requirements specific to the framework design.

> *Functional Requirement 2:* The approach should cover the end-to-end life cycle of innovation, from ideation to commercialisation, for both inbound and outbound open innovation.
>
> *Functional Requirement 3:* The approach should cover not only the innovation process but also the organisational factors that enable innovation.

Functional Requirement 11: The approach should cover the *implementation, execution* and *improvement* of open innovation.

From the functional requirements above, it can be determined that the framework design needs to accommodate different perspectives.

Firstly, the framework must assist the SME in implementing open innovation as a chosen method of innovation. It should provide the SME with guidance on how to set up the organisation to innovate in a more open way.

Secondly, the framework must provide a process of performing open innovation. This is the process of developing a new innovation that can be taken to market.

Thirdly, the framework must assist the SME in improving their innovation capability over time. As the organisation gets more comfortable using open innovation, it can adopt more advanced techniques and consider different innovation partners. Chesbrough (2006) also suggested that there is a maturity growth that happens, impacting the organisation's business model to support open innovation as a core innovation method.

To address the three requirements, a review was done on frameworks and models in the literature that addressed these aspects.

6.2 Review of Implementation Frameworks and Models

The open innovation approach is meant to be used by SMEs to implement, establish or enhance open innovation capability in their organisations. Reviewing generic implementation models and frameworks can guide the design of the open innovation framework to satisfy this requirement. Project management methods provide a good reference to understand considerations when implementing a new way of doing things into the organisation. Standardised project management methodologies such as Prince 2 or PMBOK are well known and used within organisations from different industries to manage project implementation.

6.2.1 PMBOK

A Guide to the Project Management Body of Knowledge (PMBOK) (Project Management Institute, 2008) defines project management as "the application of knowledge, skills, tools and techniques to project activities to meet project requirements". It continues by stating that "this application of knowledge requires the effective management of appropriate processes". The PMBOK further suggests the following points for achieving a successful project:

- Select appropriate processes required to meet the project objectives
- Use a defined approach that can be adopted to meet requirements
- Comply with requirements to meet stakeholder needs and expectations
- Balance the competing demands of scope, time, cost, quality, resources and risk to produce the specified product, service or result

The PMBOK also claims that "there is general agreement that the application of project management processes has been shown to enhance the chances of success over a wide range of projects".

Considering that the open innovation approach would require initial implementation into the organisation and further implementation of innovation projects, it was decided to evaluate the PMBOK processes, as a framework consideration for the open innovation approach.

Project management processes are grouped into five categories known as Project Management Process Groups and described in the PMBOK (Project Management Institute, 2008) as:

- Initiating Process Group: those processes performed to define a new project or a new phase of an existing project by obtaining authorisation to start the project or phase.
- Planning Process Group: those processes required to establish the scope of the project, refine the objectives and define the course of action required to attain the objectives that the project was undertaken to achieve.
- Executing Process Group: those processes performed to complete the work defined in the project management plan to satisfy the project specifications.
- Monitoring and Controlling Process Group: those processes required to track, review and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
- Closing Process Group: those processes performed to finalise all activities across all Process Groups to formally close the project phase.

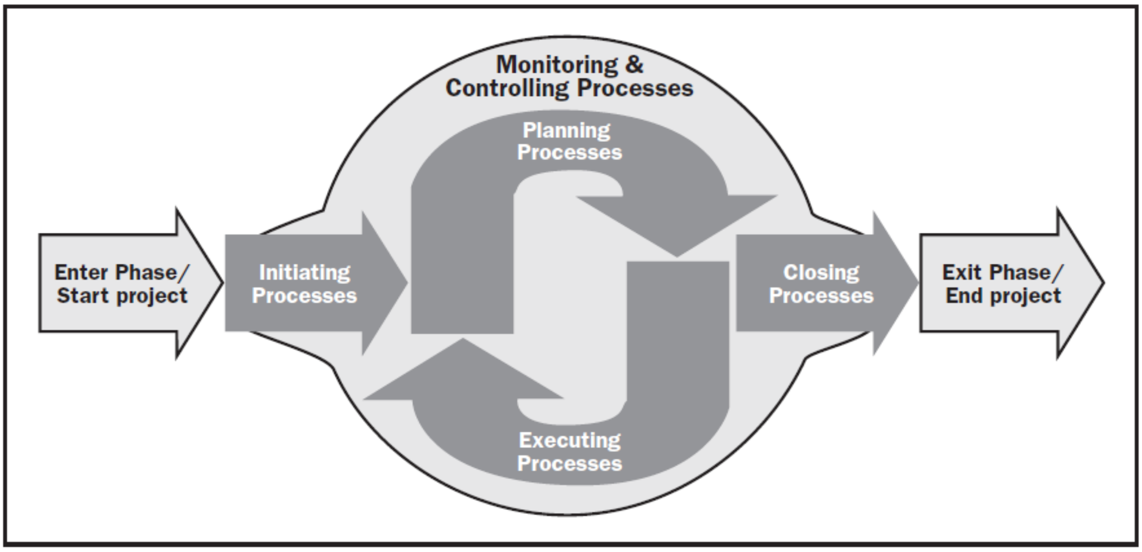


FIGURE 6-1: PROJECT MANAGEMENT PROCESS GROUPS (SOURCE: PMBOK GUIDE - FOURTH EDITION)

The project management processes from the PMBOK guide are robust enough to be applied to various types of projects and have gone through various quality reviews to update the processes to a high standard. The process tasks within the PMBOK guide underpinning the process groups are very detailed and can be overwhelming for most SMEs, but the higher-level process groups should, however, still be relevant to consider for developing an open innovation framework.

6.2.2 SDLC

The System Development Life Cycle (SDLC) is a commonly used framework for system or software development. Although variations of the model exist (Ragunath, 2010; Rhodes, 2012; Tutorialspoint, 2014), the common phases of the life cycle include the following:

Planning

This phase is where planning takes place for the system development project. It initiates the project and determines the project approach. Planning is not a once-off process, since planning at this stage is based on limited information. More detailed planning is performed when information becomes available to assist in this process to ensure a more accurate plan.

Requirements

The analysis and definition of requirements for the intended system are performed during this stage. Requirements are normally provided by the end user of the system. The requirements will describe what needs to be accomplished by the system (what the system will be used for), the functions the system must be able to perform, quality attributes required, together with performance and user requirements.

Design

After the requirements have been defined, a system design is created that describes how the requirements will be met. The design will be used as input during the development phase. The design may include “functional hierarchy diagrams, screen layout diagrams, tables of business rules, business process diagrams” (Rhodes, 2012) or other artefacts describing the final system.

Development and Testing

The system is built in this phase and tested for conformity against the requirements. During software development, testing can include functional testing, integration testing and user acceptance testing. At the end of development and testing, the system should be ready for deployment.

Deployment

The system is deployed into the organisation for operational use or into the market as a product. During this stage maintenance and updates might also be provided. This will extend the lifetime of the system and improve it with feedback from users.

6.2.3 Discussion

The two methodologies reviewed above show similar high-level characteristics in their design. There is a clear distinction between phases within the methodologies, focusing on different outcomes. The methodologies provide guidance on implementation, but also consist of processes within the higher-level phases. They therefore cover different dimensions simultaneously.

Although the methodologies seem to be linear in nature, both have potential iterative process loops that can occur during the development or execution phases. Both methodologies also have an initial planning and preparation phase before moving into the execution phases.

6.3 Review of Improvement Frameworks and Models

6.3.1 PDSA

The Plan Do Study Act (PDSA) cycle provides a “method for structuring iterative development of change, either as a stand-alone method or as part of wider Quality Improvement (QI) approaches, such as the Model for Improvement (MFI), Total Quality Management, Continuous QI, Lean, Six Sigma or ‘Quality Improvement Collaboratives’” (Taylor et al., 2013).

In 1993 Edwards Deming modified the Shewhart cycle and called it the Shewhart Cycle for Learning and Improvement or in its better-known format, the PDSA cycle (Moen and Norman, 2010). “Deming described it as a flow diagram for learning and improvement of a product or a process” (Moen and Norman, 2010). The PDSA cycle contained the following steps:

- Plan—Plan a change or test aimed at improvement.
- Do—Carry out the change or test (preferably on a small scale).
- Study—Examine the results. What did we learn? What went wrong?
- Act—Adopt the change, abandon it or run through the cycle again.

The PDSA cycle is an accumulation of changes to the original Shewart cycle introduced in 1950 that contained the three steps; Specification, Production, and Inspection (Moen and Norman, 2006). The cycle subsequently evolved into the Deming Wheel with the following steps (Moen and Norman, 2010):

- Design the product (with appropriate tests).
- Make the product and test it in the production line and in the laboratory.
- Sell the product.
- Test the product in service and through market research. Find out what users think about it and why non-users have not bought it.
- Redesign the product, in the light of consumer reactions to quality and price. Continue around and around the cycle.

The Deming Wheel was reframed by the Japanese into the Plan Do Check Act (PDCA) cycle to include the following steps (Moen and Norman, 2010):

- Plan: Define a problem and hypothesise possible causes and solutions.
- Do: Implement a solution.
- Check: Evaluate the results.
- Act: Return to the plan step if the results are unsatisfactory, or standardise the solution if the results are satisfactory.

Gerald Langley, Kevin Nolan and Thomas Nolan added three basic questions to supplement the PDSA cycle constituting the Model for Improvement. "This new approach provides a basic framework for developing, testing and implementing changes to the way things are done that will lead to improvement" (Moen and Norman, 2010).

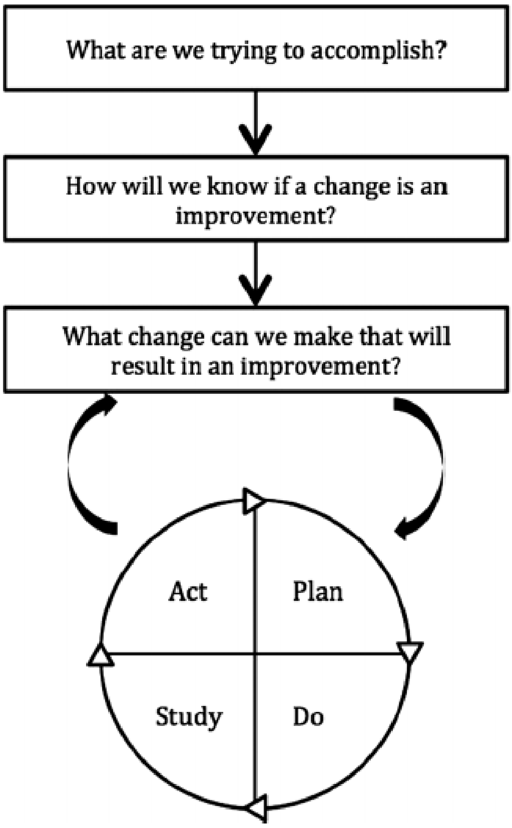


FIGURE 6-2: MODEL FOR IMPROVEMENT (SOURCE: MOEN AND NORMAN, 2010)

6.3.2 OI Maturity Framework

Companies implementing open innovation will require cycles of continuous improvement to increase their open innovation capability, thereby also increasing their open innovation maturity (Enkel et al., 2011). Enkel et al. (2011) described a maturity framework for open innovation in companies ranging from immature to medium-mature to mature, based on the ability of the organisation's innovation processes to be defined as initial/arbitrary, repeatable, defined, managed and optimised. The open innovation maturity framework assesses the maturity of a company's open innovation in the context of three overarching categories. These are:

- Climate for innovation
    - Leadership
    - Incentives
    - Mind set
- Partnership capacity
    - Reputation
    - Partner selection
    - Training and education
- Internal Processes
    - Central coordination
    - Resources
    - Knowledge management processes
    - Legal and intellectual property systems

The open innovation maturity framework therefore provides support to the notion that an open innovation approach would require continuous improvement to mature the open innovation capability within an organisation. It also emphasises the improvement across the various components of open innovation as described earlier in this chapter.

6.3.3 Discussion

The maturity framework and improvement cycle described above both support continuous improvement. They make use of iterative cycles to mature and improve various process or framework components. In the PDSA model, the focus is on the iterative cycles that must be followed for improvement i.e. the phases of continuous improvement. In the maturity model, the focus is on the components that need to mature within open innovation, posing maturity levels that must be obtained, but with the iterative improvement cycles structured as an underlying assumption for maturity.

The one model therefore shows the improvement phases, while the other model shows the components to be improved. But both drive the same intention – cycles of continuous improvement to mature a given capability.

6.4 Review of Innovation Frameworks and Models

Next within the process of research synthesis, is to review innovation frameworks and models to obtain a general view of how innovation frameworks are structured and the elements required therein. This will further help shape the design of the open innovation framework for this study.

6.4.1 A.T. Kearney House of Innovation

The A.T. Kearney House of Innovation (IMP^{3}rove Acadamy, 2012) provides an integrated approach to innovation management, linking innovation strategy, organisation and culture, innovation process and enabling factors. These elements interlink to produce innovation results.

The House of Innovation (Figure 6-3) is reminiscent of a business architecture model in its design. The model starts off with an innovation strategy, which should be aligned to the organisational strategy. Within the innovation strategy, the company sets the strategic focus for innovation and decides how the strategy will be implemented.

The innovation strategy informs the innovation organisation and culture. The organisational roles and responsibilities (such as innovation team structures and mandates) are defined, together with the planned culture to be established. This will include decisions on risk appetite and employee motivation and incentives.

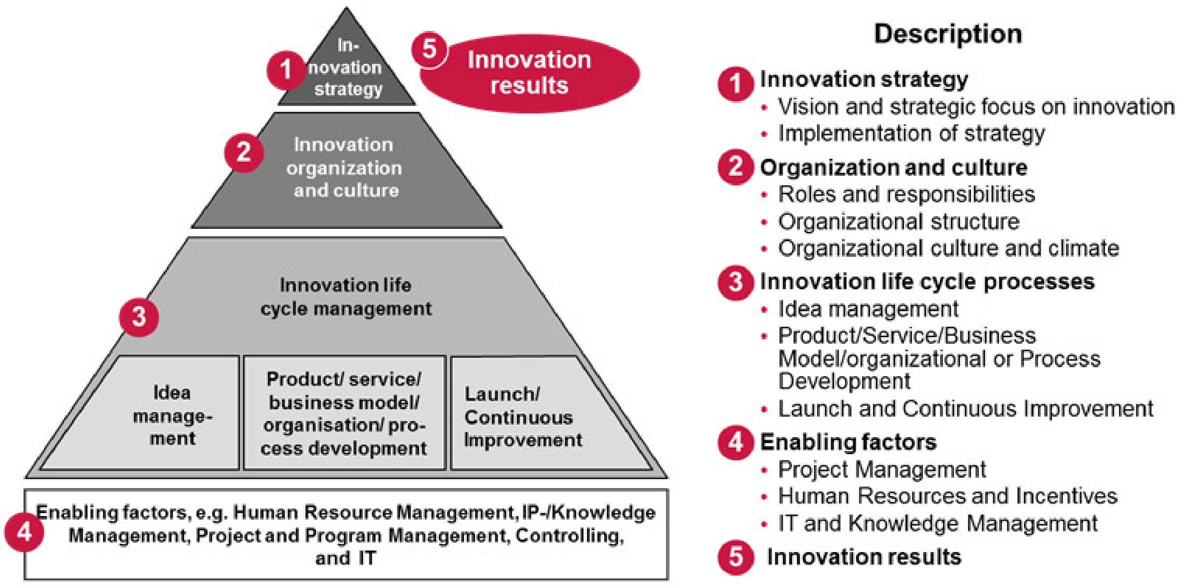


FIGURE 6-3 A.T. KEARNEY HOUSE OF INNOVATION (SOURCE: A.T. KEARNEY)

Innovation life cycle management will include the processes for managing innovation in the organisation. It will include an organisation-wide process from the time an idea is generated through to innovation selection and development, up to launching and maintaining the new innovation.

Supporting the innovation process are enabling factors such as human resource management, IT, project and portfolio management and the management of knowledge and IP.

6.4.2 Fugle Model

The Fugle innovation model from Du Preez and Louw (2008) provides another view on the different elements required for innovation. The Fugle model is a synthesis from various process innovation models in literature. The model aims to “help businesses to identify, evaluate, develop, implement and exploit new products and services more efficiently and effectively” (Du Preez and Louw, 2008).

At the core of the Fugle model is an innovation process that facilitates an innovation life cycle from idea generation through to commercialisation and exploitation. Ideas pass through 'filters', which sort innovation opportunities into a portfolio of innovation projects. These projects are then deployed into the market and further optimised to gain most value from the innovation. This is not a pure linear process, but includes iterations within the process. The Fugle model allows for participation from internal and external sources during the innovation process, supporting the notion of open innovation.

As with the A.T. Kearney House of Innovation, the Fugle model also incorporates strategy, people and culture, information and knowledge and organisational structures and processes into the innovation model.

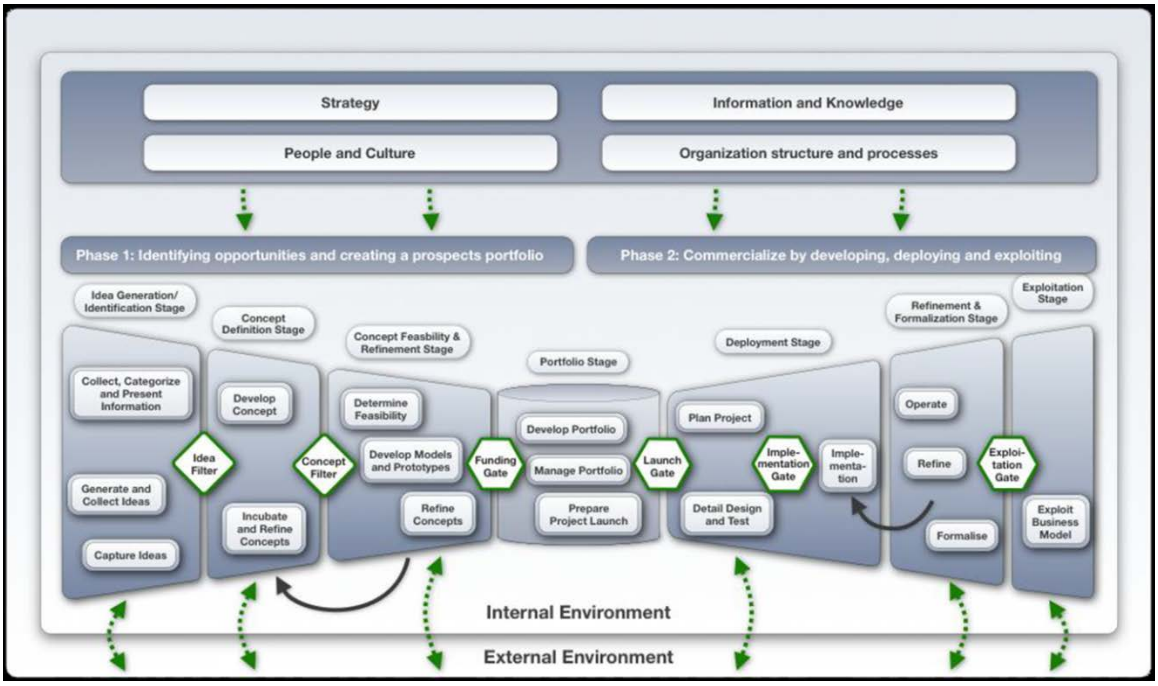


FIGURE 6-4: FUGLE MODEL (SOURCE: DU PREEZ AND LOUW, 2008)

6.4.3 Integrated Causal Framework

In an empirical research study on the Performance Impact of Open and Collaborative Innovation Strategies (Brunswicker, 2011), the Integrated Causal Framework (Figure 6-5) was used to demonstrate "relevant components and constructs in an integrated manner and details multivariate relationships among independent and dependent variables in order to explain innovation performance and value growth". The research examined Open and Collaborative Innovation based on a large set of firm-level data of SMEs. The model takes in consideration open innovation strategies, external influences and internal organisational practices for innovation that leads to value creation.

The Integrated Causal Framework recognises the impact of controlling factors on the SME's innovation capability in the form of the type of industry the organisation is involved in, the size and age of the organisation (alluding to maturity) and so forth.

The framework includes (Open and Collaborative) innovation strategies that lead to innovation-based value creation. These are comparative to the 'innovation results' from the A.T. Kearney innovation model. Innovation-based value creation is measured separately in terms of innovation success, income from innovation, income from major innovation and income growth.

Environmental factors such as the efficiency of IP protection and how dynamic the innovation environment is (degree of uncertainty and turbulences in market and industry conditions) are also taken into consideration.

Internal innovation practices in the framework are represented by the following (Brunswicker, 2011).

- Innovation planning (organisational innovation strategy and plan)
- Culture for innovation (is innovation embedded into the organisation's culture?)
- Innovation development process (the organisation's innovation process, such as stage gate)
- Innovation controlling (innovation measurements and controlling mechanisms)
- Investment into knowledge base (resources invested into innovation)

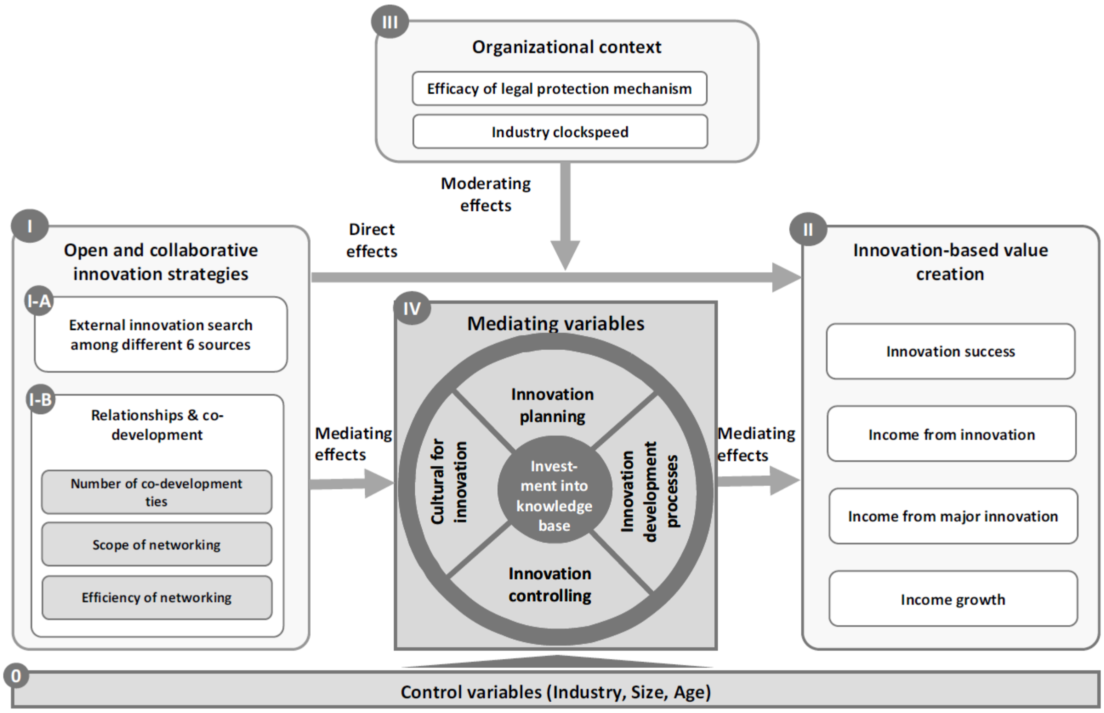


FIGURE 6-5: INTEGRATED CAUSAL FRAMEWORK (SOURCE: BRUNSWICKER, 2011)

6.4.4 Enablers and Building Blocks of Open Innovation

In a report on open innovation titled: *How to implement open innovation: Lessons from studying large multinational companies* (Mortara et al., 2009), the authors provide four enablers and obstacles to open innovation that should be considered when implementing open innovation. The report is based on two years' research within the Cambridge Open Innovation Network. The four areas mentioned are:

- Open Innovation Culture (a shift of culture, whereby working with other companies became accepted and endorsed throughout the organisation)
- Open Innovation Procedures (team structures and internal networks, enabling infrastructure and tools)
- Open Innovation Skills (training for open innovation: introspective, extrospective, interactive and technical skills)
- Open Innovation Motivation (incentivising and rewarding for open innovation)

Golightly et al. (2012) furthermore suggested a list of building blocks needed to develop and deliver open innovation. The building blocks are:

- Open innovation strategy
- Organisation
- Leadership
- Culture
- Tools / Processes
- Metrics
- Ecosystem interactions
- Skills

- Business models/IP

6.4.5 Discussion

From the literature review section on the innovation frameworks and models, common elements can be derived. Delineating these elements further based on the review and making it relevant to open innovation, the following key elements were identified to assist in the development of an open innovation framework.

TABLE 6-1: INNOVATION MODEL COMPARISON TABLE

	A.T. Kearny	Fugle	ICF	COIN	Golightly
Open Innovation Strategy	X	X	X	-	X
Open Innovation Culture	X	X	X	X	X
Open Innovation Information and Knowledge	X	X	X	-	-
Intellectual Property Management	X	X	X	-	X
Organisational Structure	X	X	X	X	X
Open Innovation Skills Development	X	X	X	X	X
Open Innovation Process	X	X	X	-	X
Open Innovation Measurement	-	-	X	-	X
Enabling Factors	X	X	X	X	-

Table 6-1 provides a comparison of the common elements identified and how those elements are prevalent within the discussed models/frameworks. The frameworks cover a range of similar elements. Most elements are considerations additional to the process of innovation itself. The Fugle model is the only model to place the innovation process as a central focus point around which the other elements are included. The other models and frameworks do not expand on the innovation process activities, but only list the innovation element as a framework component. The key elements abstracted from the models and frameworks are:

Strategy – The majority of frameworks include strategy or planning for open innovation. It links the innovation to be performed to the business strategy and sets out the approach for open innovation to be implemented.

Culture – All the frameworks include innovation culture as an important consideration for open innovation success. It stresses the people behaviour change that needs to happen within the organisation to promote the adoption of open innovation as a chosen innovation method.

Information and Knowledge – Three of the five frameworks include the management of knowledge and information. This includes the actual information artefacts and the tools to manage the storage and sharing of information between and within networks.

Intellectual Property – Managing IP is considered in four of the five frameworks reviewed. It plans for how IP will be managed during the innovation process, selecting the best strategic options and processes for protection during and after the innovation process.

Organisational Structure – How the organisation is set up to support open innovation is included in all five frameworks. It covers functional structure and people roles and responsibilities.

Skills – Employees will need to learn new skills to do open innovation. This is recognised in all the frameworks reviewed. Employees will need to learn the required tools, techniques and behaviours required to innovate in a more open way.

Process – The open innovation process is where the development of the innovation happens. Four frameworks explicitly mention the innovation process (although the Cambridge Open Innovation Network does allude to it through their reference to procedure). The innovation process covers all the steps from ideation to commercialisation and beyond for an innovation. Only the Fugle model describes the innovation process in detail with all its steps and components.

Measurement – Innovation metrics and measurement are the least-frequent element in the frameworks with only two mentioning it directly (The Fugle model does have feedback loops within the innovation process that could be considered in measurement as well as the innovation results element found in the A.T. Kearney model that alludes to some form of measurement and metrics). The measurement of the innovation process and outcome can provide input into the improvement cycle of an innovation capability.

Enabling Factors – The frameworks provide various other factors to consider that support and enable the open innovation process and adoption success. Incentives, investment, leadership support are all examples within this category.

6.5 Deriving the Open Innovation Framework Architecture

From the review of the models and frameworks discussed in sections 6.2 to 6.4 it appears that they function on two different levels of abstraction. The implementation and improvement frameworks focus mostly on the 'higher-level' phases required to complete a continuous improvement cycle from planning, to executing, to reviewing and improving. These are more generic in nature. The innovation frameworks and models focused mainly on the different 'next-level' elements to include in the framework to make open innovation successful in the organisation. It gives the innovation specific building blocks the organisation must consider on a more practical level. To satisfy the three functional requirements mentioned in section 6.1, these two different levels of abstraction and focus need to be combined into a single framework.

First, an architecture can be derived for the open innovation framework. It considers the continuous improvement life cycle phases when adopting open innovation. Secondly, the innovation-specific components required within these life cycle phases are developed to form the framework.

From the frameworks and models described in the review sections above, the following is derived to serve as the architecture for the open innovation framework where four generic life cycle phases emerge (Figure 6-6).

Plan and Prepare for OI

All the implementation models reviewed have a planning phase that prepares and sets up the organisation for change. This happens on a micro level (that of the project) and on a macro level (that of the organisation). It therefore covers the planning and implementation of the open innovation approach in the organisation, but also the planning and implementation of individual innovation projects for execution, so resulting in two levels of abstraction.

Perform OI

Once the organisation is set up for open innovation, it needs to operate in this manner. Open innovation is performed to develop new products, services or other types of innovation. These innovations are then implemented into the organisation or into the market. Thus, it covers the process of innovation from idea to market, in an open way.

Measure and Evaluate OI

The success of the open innovation implementation and execution needs to be measured. Key performance indicators of innovation metrics are assessed to establish the effectiveness of innovation. Learnings are also obtained from the implementation and execution processes that can be used for improvement and to grow the open innovation maturity of the organisation.

Improve and Mature OI

From the models reviewed, it emerged that implementing and executing open innovation is not a once-off event. Organisations should continuously improve and mature their open innovation capability, aligned to their business and innovation strategies and learning through feedback from their initial efforts and performance.

The four-phased structure therefore provides a generic architecture that can be used to build the innovation components into. It covers the higher level of abstraction of implementation, execution and improvement as phases for the framework.

FIGURE 6-6: OPEN INNOVATION FRAMEWORK ARCHITECTURE

6.6 Deriving the Open Innovation Framework Elements

The previous section set up the architecture within which the innovation building blocks or elements can be incorporated, forming the framework components. Nine elements were identified during the literature review from the innovation models. The elements are:

- Open Innovation Strategy
- Open Innovation Culture
- Open Innovation Information and Knowledge
- Intellectual Property Management
- Organisational Structure
- Open Innovation Skills Development
- Open Innovation Process
- Open Innovation Measurement
- Enabling Factors

The following section develops the elements further, combining the elements into the four architecture phases as well as identifying additional elements for inclusion.

6.6.1 Plan and Prepare for OI

Within the 'Plan and Prepare' phase, organisational enablement takes place, that is, setting up the organisation for open innovation adoption and execution. Reviewing the open innovation elements identified, we can assign seven elements to the 'Plan and Prepare' phase within the framework (Figure 6-7). These elements all refer to the tasks and activities that need to be performed prior to calling on the innovation process to develop a new innovation.

<u>Plan and Prepare for OI</u>

Organisational Enablement:

- Open Innovation Strategy – the strategic intent and innovation goals for open innovation linked to the business strategy of the organisation
- Open Innovation Culture – the people behaviour change that needs to happen within the organisation to promote the adoption of open innovation as a chosen innovation method
- Open Innovation Information and Knowledge – the processes and tools for creating, storing and sharing of information between and within networks
- Intellectual Property Management – managing and protecting IP during and after the innovation process
- Organisational Structure – how the organisation is set up functionally to support open innovation
- Open Innovation Development Process – learning the required tools, techniques and behaviours required to innovate in a more open way
- Enabling Factors – other factors to consider that support and enable the open innovation process and adoption success such as incentives and investment

Putting these elements in place will assist the organisation to be ready for executing the innovation process. These elements remain relevant during the innovation process as well, but they require upfront implementation and adoption.

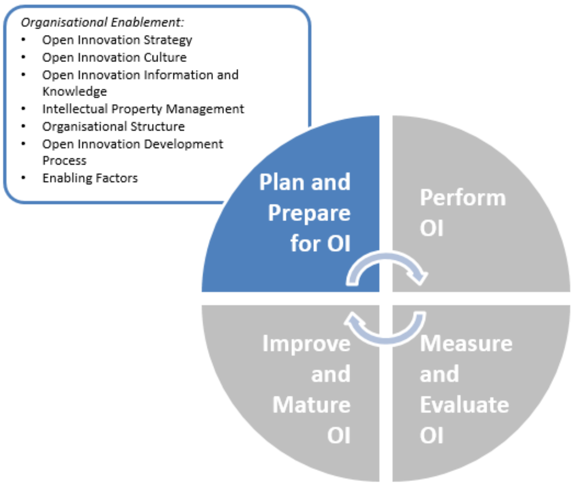


FIGURE 6-7: PLAN AND PREPARE OPEN INNOVATION ELEMENTS

6.6.2 Perform OI

An open innovation process is required to execute open innovation in the organisation based on the open innovation strategy developed during the 'Plan and Prepare' phase and within the structures set up for enablement. One of the elements previously identified in this chapter for open innovation was the 'Open Innovation Process'.

Following the same structure format as with 'Plan and Prepare', we can show the 'Open Innovation Process' under 'Perform OI' as follows.

<u>Perform OI</u>

Open Innovation Process

This will form the high-level structure for the 'Perform Open Innovation' phase, but requires further detailed sub-elements. Referring back to the Fugle model and the A.T. Kearny innovation model, the following innovation process elements are mentioned.

A.T. Kearney innovation model:

- Idea management
- Development
- Launch and Continuous Improvement

Expanding on the Fugle model in more detail it makes clear some of the in-depth tasks taking place throughout the innovation process:

- Idea generation – the creative stage when new opportunities or ideas are identified from sources internal or external to the organisation.
- Concept definition – transforming the idea or a combination of ideas into a feasible concept through incubation and refinement.
- Feasibility – further refinement and investigation of the concept, obtaining more information, as well as modelling and prototyping to determine its feasibility.
- Portfolio – managing the organisation's innovation initiatives in a holistic manner, assigning resources and responsibilities and monitoring initiative performance against the strategy.
- Development – the design, development, roll-out and testing of the innovation.

- Refinement and Formalisation – monitoring, measuring, evaluating and refining the solution until it functions satisfactorily according to specifications.
- Exploitation – generating more value from the innovation through new business models and markets.

The level of detail provided is different based on the chosen gating decisions in the processes and how certain steps are combined or expanded on. These elements are, however, fairly consistent within innovation processes. Other examples of innovation processes in the literature are:

The four-step approach (Wright, 2007):

- Idea generation
- Formulation
- Pilot
- Roll-out

The 'bow-tie' process (Gaule, 2011):

- Research
- Development
- Commercialisation

Open innovation funnel process (Loren, 2011):

- Design
- Implementation
- Introduction and Adoption

Another ‘stage-gate’ innovation process, like the Fugle model, is the Open Innovation Stage-Gate Process shown in Figure 6-8 (Cooper, 2016). It incorporates in-bound and out-bound open innovation concepts within a standard Stage-Gate innovation process. Cooper (2016) suggested open innovation to be prevalent in the following stages of the process:

Ideation or discovery stage: Organisations look externally for available ideas and technologies that can be used as a basis for internal or joint development.

Building the business case: Seeking and selecting innovation partners, managing IP concerns, perform (jointly) feasibility studies and business case development.

Development stage: Development is performed with partners external to the organisation or external technologies incorporated into the development process. Organisations can also out-license or sell technology that won’t be taken to market within their own process.

Launch or commercialisation stage: Sell or out-license commercialised innovations to obtain more value from them or acquire commercialised innovation from a source external to the organisation to further exploit them.

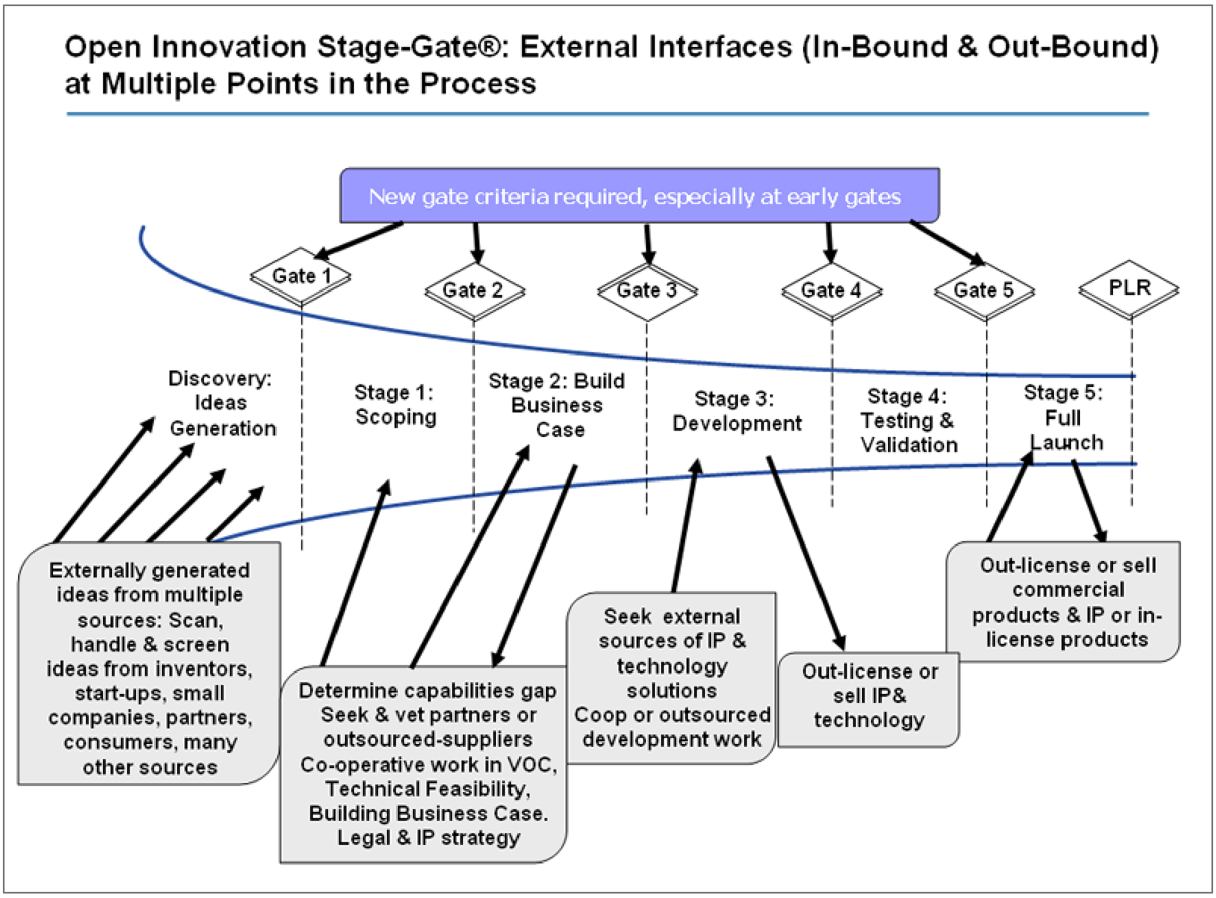


FIGURE 6-8: OPEN INNOVATION STAGE-GATE PROCESS (SOURCE: COOPER, 2016)

The open innovation process needs to satisfy the functional requirement from chapter 5 being:

> *Functional Requirement 2:* The approach should cover the end-to-end life cycle of innovation, from ideation to commercialisation, for both inbound and outbound open innovation.

The open innovation elements selected from the various innovation models must therefore be comprehensive enough to be used for the various innovation scenarios.

Based on the above, the following expanded component structure for the 'Perform Open Innovation' phase is defined (Figure 6-9):

<u>Perform OI</u>

Open Innovation Process:

- Opportunities Discovery and Ideation – problem/opportunity areas are identified and ideas sourced internally or externally to address those needs
- Conceptualisation and Selection – ideas are further developed into concepts and prototypes, then selection choices are made for development
- Development and Portfolio Management – development of new products or services are managed and performed internally or with partners
- Deployment and Protection – innovations are protected for commercial rights and launched into the market or provided to external parties for use

- Improvement and Exploitation – innovations are further improved and exploited to increase maximum value from the products or services through additional features, applications or external IP licensing or sales

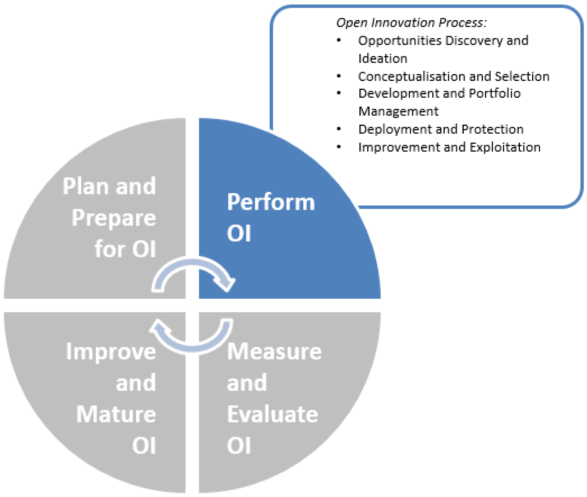


FIGURE 6-9: PERFORM OPEN INNOVATION ELEMENTS

6.6.3 Measure and Evaluate OI

To continuously improve the open innovation capability within the organisation, it is imperative to measure and evaluate performance and results. Measurement provides a feedback loop to the SME to understand how successful the implementation and execution of open innovation are in the organisation and where performance can be improved. The open innovation element of 'Open Innovation Measurement' identified previously addresses this aspect. A set of open innovation metrics is required to determine how the innovation processes is performing (Erkens et al., 2014). These KPIs should measure performance across the innovation process, from ideation up to deployment and exploitation. These metrics should then be used in a formal review of the performance of the 'Open Innovation Process'. Golightly et al. (2012), however, found that defining KPIs for open innovation is a big challenge for organisations. KPIs are often implemented based on a trial-and-error basis (MED, 2012). The open innovation framework should therefore consider different types of innovation KPIs such as profit from innovations, profit per employee or income from patents and license fees (Chesbrough & Brunswicker, 2013; West & Bogers, 2014).

In the review of the PDSA cycle, there was an emphasis on learning that can be achieved from reviewing performance results and using the learning process to enhance future performance. Enkel et el. (2011) recommended innovation measurement and monitoring activities, stating that self-assessment assists with planning for continuous improvement. Learning can be achieved from internal company feedback or through feedback from external innovation partners. Comparing company performance against industry benchmarks can also be used as a method for learning.

By combining all these elements, the following framework component can be constructed under Measure and Evaluate Open Innovation (Figure 6-10):

<u>Measure and Evaluate OI</u>

Open Innovation Measurement:

- Innovation KPIs – defining key performance indicators to measure open innovation performance
- Innovation Reviews – performing reviews of the KPI measures to establish performance against targets

Open Innovation Learning:

- Innovation Lessons Learnt – conducting a self-assessment of innovation performance and defining areas of improvement relating to the open innovation activities
- Partner Feedback – requesting feedback from innovation partners for further improvement insights
- Benchmarking – leveraging benchmarking as a tool to compare performance

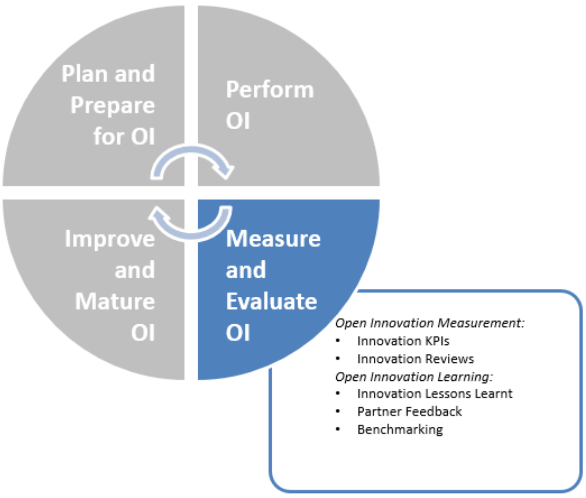


FIGURE 6-10: MEASURE AND EVALUATE OPEN INNOVATION ELEMENTS

6.6.4 Improve and Mature OI

The final framework phase is 'Improve and Mature'. Golightly et al. (2012) cautioned that it takes time and investment to successfully implement and mature open innovation in an organisation. Results and learnings obtained from the 'Measure and Evaluate' phase are used to inform changes for adoption into the organisation. This assists in continuously refining and improving the open innovation capability in the organisation.

Improvements can be applied to any of the first three framework phases of Organisation, Process and Measurement, thereby enhancing the open innovation maturity and performance. A distinction should also be made between designing the change and adopting the change within the organisation. The former addresses the process of coming up with options that can help improve the areas identified for improvement based on the measurement and learning results. The latter adopting step, is a decision from the organisation to select some or all of the options and then to adopt and apply them in the organisation. Considering that the organisation will have limited resources available, it is very likely that the organisation won't be able to implement all the options identified, but only select the most impactful ideas to maximise their return on resources.

The Improve and Mature component can therefore be described as follows (Figure 6-11):

Improve and Mature OI

Open Innovation Improvement:

- Organisational Enablement Improvement – develop ideas for improvement related to Enablement
- Innovation Process Improvement – develop ideas for improvement related to the Innovation Process
- Innovation Measurement Improvement – develop ideas for improvement related to Innovation Measurement

Open Innovation Adoption:

- Organisational Change Adoption – decide on which improvement options to adopt relating to the Organisation
- Innovation Process Adoption – decide on which improvement options to adopt relating to the Innovation Process
- Innovation Measurement Adoption – decide on which improvement options to adopt relating to Measurement

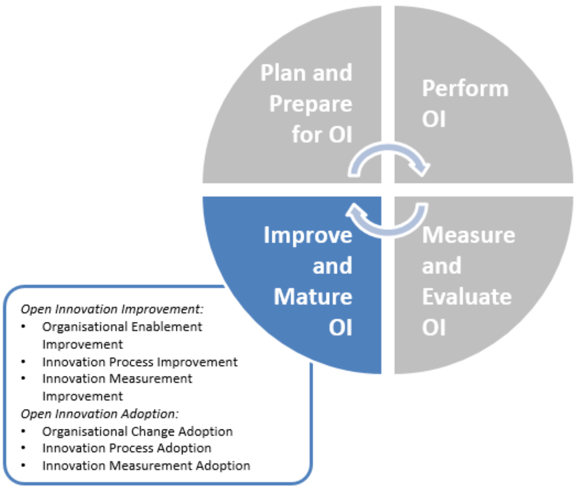


FIGURE 6-11: IMPROVE AND MATURE OPEN INNOVATION ELEMENTS

6.7 Combined Open Innovation Framework Components

6.7.1 Framework Description

The previous sections reviewed literature on innovation, implementation and continuous improvement frameworks and models. Based on the literature, phases and components were then defined for the open innovation framework. The bulk of the elements identified during the review of the innovation frameworks fitted within the first two phases of the framework. Less attention is given within the innovation framework literature to the measurement and improvement phases. Adding elements to these phases is therefore done on the limited information available at this stage of the design cycle and it will need to be expanded on and validated during the next design iteration. It does, however, highlight a gap in the literature to start addressing through the framework. Combining these components into a single framework structure, including the architecture phases and the second-level components and elements provides the following visual framework as can be seen in Figure 6-12, producing the Open Innovation Lifecycle Framework.

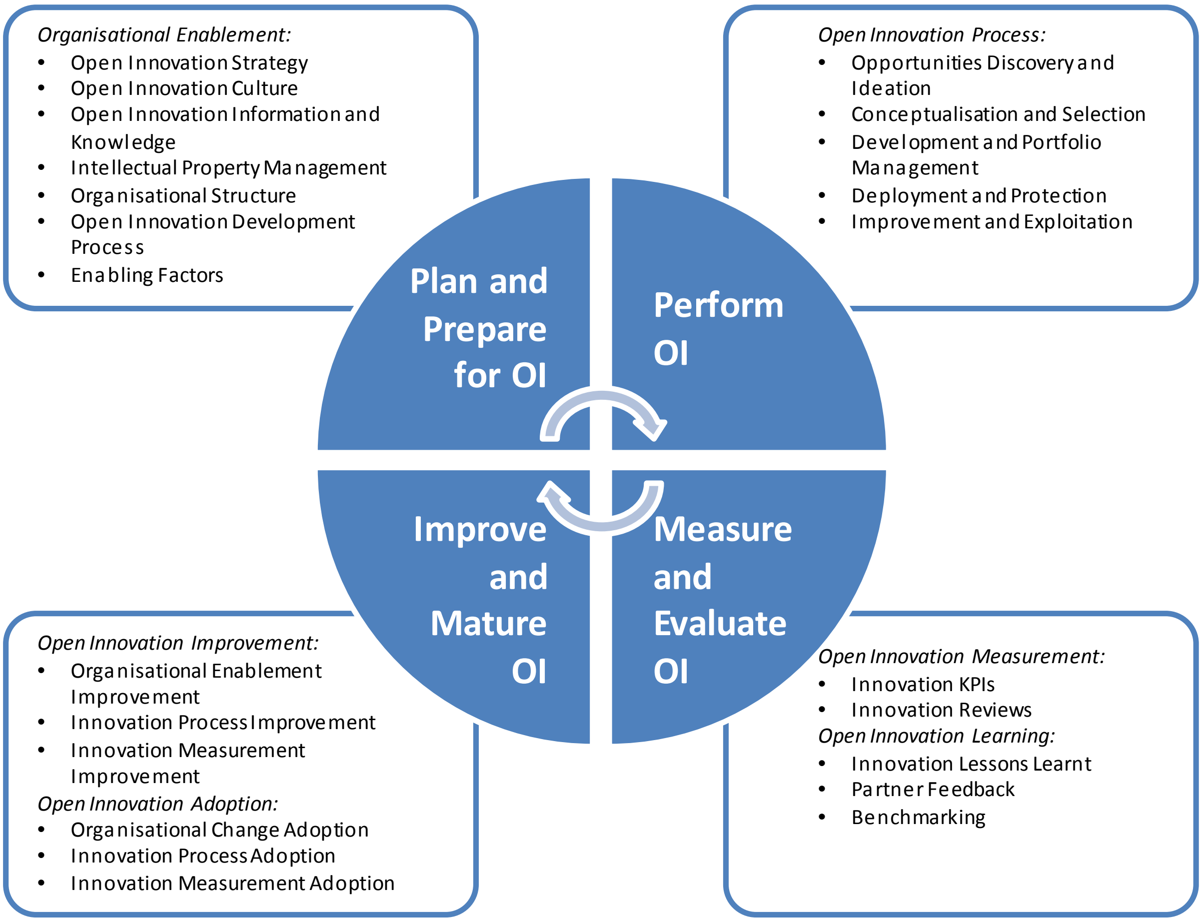


FIGURE 6-12: OPEN INNOVATION LIFECYCLE (OIL) FRAMEWORK

The Open Innovation Lifecycle (OIL) Framework comprises of four main phases, six subcomponents and twenty-three core elements. The first phase helps the organisation focus on what it wants to achieve through open innovation and sets up the enabling organisational elements to use open innovation as a chosen innovation approach. It creates the environment and supporting structures to perform open innovation.

The second phase in the OIL Framework is where the organisation executes its open innovation plan and develops an innovation in the form of a new product or service. It goes through the steps from ideation to commercialisation guided by the open innovation strategy and selected open innovation methods in an inside-out, outside-in or combined approach. Relationships with innovation partners are managed and IP protected in line with the set strategy. This phase results in the taking to market of new products, services or IP.

The third phase in the framework measures the performance of the organisation's open innovation efforts through KPIs. The organisation determines the complexity and depth of measurement to follow, but the aim remains to understand the performance with the goal to improve the open innovation activities of the organisation. Various other efforts are also taken to obtain more feedback and learning such as through partner feedback.

The last phase of the OIL Framework develops plans and options to improve the organisation's open innovation capability, performance and maturity. These ideas can be used to improve any of the other three phases of the framework. A decision, however, gets made on which ideas to implement and adopt for improvement given the natural constraints of the SME.

6.7.2 Using the Framework

Organisations implementing the framework will cycle through the four main phases to continuously mature their open innovation capability over a period of time. The *Perform OI* phase will naturally have more 'mini-cycles', as open innovation projects are executed on a more frequent basis than the review cycle of the *Plan and Prepare for OI* phase for instance. Time should be allowed for changes to the organisation's open innovation model to be embedded and stabilised. The frequency of completing a full cycle of the OIL Framework will therefore vary across organisations, being influenced by factors such as organisation size, maturity, change appetite, and innovation project turnaround times.

The twenty-three core elements might also take on different forms within different organisations. The level of Intellectual Property protection, for instance, can vary in organisations from limited to no protection through patents, to high protection where all products have registered patents. The OIL Framework thus provides flexibility in the application of the framework within an organisation.

Each main component, although capable of standing on its own, should be performed within the life cycle for an integrated and complete open innovation approach. It thereby not only focuses on the process of open innovation as with many other frameworks, but also the enablement, and measurement thereof. Additionally, the life cycle framework also ensures continuous improvement of the overall open innovation capability of the organisation.

6.8 Chapter Conclusion

The fourth secondary objective defined for this dissertation was

SRO4: To develop a framework for an open innovation approach for SMEs in order to support the main research objective of this study to *develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations*.

In this chapter, a framework is developed for the implementation and execution of open innovation within SMEs. The framework also follows an iterative cycle of continuous improvement, aiming to improve the capability and maturity of open innovation within the organisation that implemented the framework.

First, an architecture was defined with four phases within the life cycle of innovation in an organisation, being:

1. Plan and Prepare
2. Perform
3. Measure and Evaluate
4. Improve and Mature

Thereafter, the framework was populated with innovation building blocks within each of the phases.

Developing the framework forms the first iteration of the design step in the design sciences research method set out in chapter 2 and will form the basis of the open innovation approach. The framework also starts to address three of the functional requirements developed in chapter 5.

> *Functional Requirement 2:* The approach should cover the end-to-end life cycle of innovation, from ideation to commercialisation, for both inbound and outbound open innovation.
>
> *Functional Requirement 3:* The approach should cover not only the innovation process but also the organisational factors that enable innovation.
>
> *Functional Requirement 11:* The approach should cover the *implementation, execution* and *improvement* of open innovation.

It should be noted that although the intention was that the framework be designed for SMEs, it appears generic enough to also be used by larger organisations. This could be due to the pragmatic approach followed to derive the framework and simplicity of the design to make it accessible to SMEs for implementation. Another reason for this might be due to the limited reference material available on SME specific open innovation frameworks and models, from which elements could be abstracted for inclusion into the framework. Reliance was therefore placed on innovation models that are more generic in nature or more commonly used within larger organisations, a much bigger research field than that of SMEs.

In the next iteration of the design step, adding more detailed descriptive information in the form of design propositions, this issue will be addressed making the approach more specific to SMEs and open innovation.

Chapter 7: Design Propositions

Moving into the second iteration of the design step of the design sciences method positioned in chapter 2, this chapter proposes design propositions for the open innovation approach. The chapter follows on from the previous two chapters that provided the base for the design propositions in the form of the design requirements and the Open Innovation Lifecycle (OIL) Framework. The chapter will once again draw from the literature, basing the design propositions on a synthesis of literature on open innovation and other business management method best practices. In doing so, the fifth secondary research question and objective as defined in chapter 1 will be addressed.

SRQ5: What design propositions can we develop for an open innovation approach for SMEs?

SRO5: To develop design propositions for an open innovation approach for SMEs

The systematic review during this chapter looks to answer the above question and objective by understanding what information, patterns, trends, and learning can be obtained from literature, framed by the OIL Framework, which would assist with developing design propositions for open innovation in SMEs. Referring back to the simplistic house analogy used in chapter 6, the design propositions form the furniture that is placed within the house structure (i.e. the OIL Framework). The propositions become a toolset for the SME to select from and use in the application of the open innovation approach.

Weber (2011) argued that developing design propositions as an output from research synthesis "can provide an effective means of producing actionable knowledge base with which the dislocation of research from practice can be overcome, enabling managers to make better use of academic research". In chapter 2 it was mentioned that the application domain of design science is placed within management theory. The design propositions derived through synthesis follow a heuristic – or means-end statement (Andriessen, 2004) – in the form of: If you want to achieve outcome C, in context A, then use action B. The design proposition therefore provides a proposed action to address a specific field problem in context that a user can apply to achieve an intended outcome, based on prior knowledge.

The chapter first introduces three concepts that help to structure and navigate the design propositions:

- Using the OIL Framework from chapter 6 to frame the design propositions,
- Adopting CIMO-logic to structure each design proposition statement, and
- Using open innovation maturity as a context type to differentiate recommended interactions within the design propositions.

Following the introductory section, the design propositions are developed in detail. The design propositions developed in this chapter have been published as a journal article and presented at an academic conference (Krause & Schutte, 2016).

7.1 Framing the Design Propositions

To focus the systematic review of literature and research synthesis, the author made use of the Open Innovation Lifecycle Framework defined in chapter 6 to guide the process. By using the OIL Framework, boundaries for the review are set and act as an initial step to a systematic review of the parameters or question to be answered (Biolchini et al., 2005; Khan et al., 2003; Booth et al., 2012). Using our simplified analogy above, it forms the house in which to place the furniture.

Recapping from the previous chapter, the OIL Framework is based on models and frameworks from the literature and was developed as a precursor to the development of the open innovation approach for SMEs. The four main phases of the framework are: 'Plan and Prepare for OI', 'Perform OI', 'Measure and Evaluate OI', and 'Improve and Mature OI'. The OIL Framework follows an iterative cycle similar to the Plan Do Check Act (PDCA) cycle (Moen & Norman, 2010), that allows the process to be improved, rather than being a once-off exercise. The OIL Framework was designed using design requirements (including user requirements, functional requirements, design restrictions, attention points and boundary conditions) developed in chapter 5. References will be made to the requirements where applicable throughout the development of the design propositions.

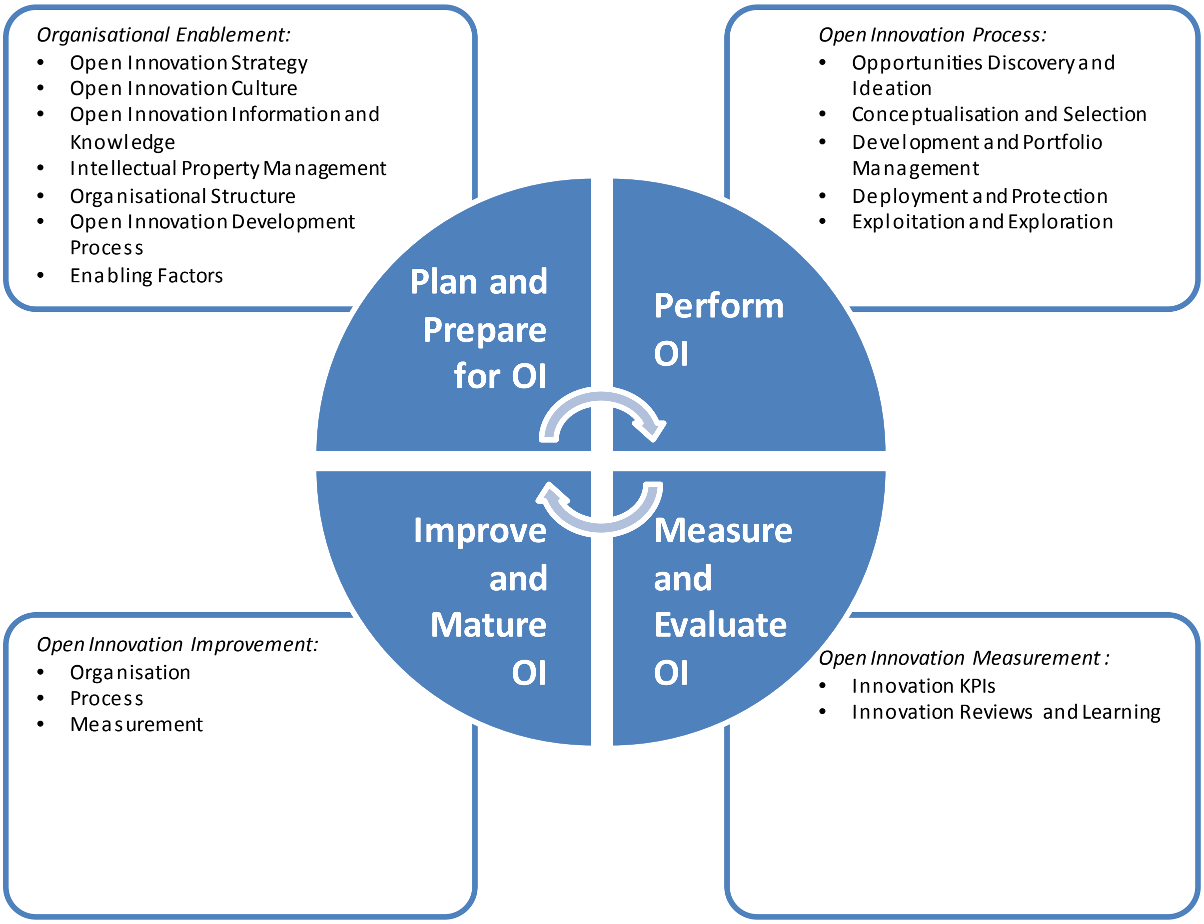


FIGURE 7-1: OIL FRAMEWORK V2[4]

7.2 The CIMO-Logic Table

Chapter 2 introduced CIMO-logic that will be used to structure the design propositions in this chapter. CIMO-logic driven design propositions are often used in design science research. Design propositions can be formulated through primary empirical work or through existing literature and research (Denyer et al., 2008; Tranfield et al., 2003). Although based on the technological rule (Bunge, 1967), the design

[4] The revised framework (OIL Framework V2) is shown here after changes were applied during the design cycle in this chapter. See notes on changes in Appendix B

proposition is not intended to be mechanistic in nature or provide precise instructions (Denyer et al., 2008). It forms input into the solution design of a field problem, or as mentioned in chapter 6, in this study, design propositions form part of the toolset to use within the open innovation approach.

CIMO-logic can be used in the form of one-liners, tables, articles, reports, guidance notes or even books (Van Aken, 2013; Van Staveren, 2009; Weber, 2011). To facilitate ease of use, the author chose to capture the design propositions in a tabular format, underlined by detailed description notes from the literature.

The CIMO design proposition table shows the relationships between context, intervention, mechanism and outcome. These relationships are not necessarily a one-to-one relationship and can include many-to-one and one-to-many relationships (Denyer et al., 2008; Tan, 2010; Van Staveren, 2009; Weber, 2011). A single outcome can therefore be achieved, through multiple interactions and mechanisms within a single context, for example.

Considering the main research problem and following the example of Weber (2011), the first and over-arching design proposition can therefore be described as below. The CIMO-logic within the design proposition is coded using the CIMO acronym and a number.

The open innovation approach is to be used in the implementation, execution and improvement of open innovation by SMEs in their organisations. This sets the 'context' for the first overarching design proposition. The 'interaction' that the SME must follow in this context is to use the OIL Framework and design propositions within the open innovation approach. The approach contains the routes and actions for the SME to implement, execute and improve open innovation in their organisation. The intended outcome for the approach is to provide a structured way to improve open innovation within the SME.

TABLE 7-1: DESIGN PROPOSITION 1

Context	Interaction	Mechanism	Outcome
For SMEs to implement, execute, and improve open innovation in their organisations (C1)*	Use the OIL framework and design propositions (I1)	That contains appropriate routes and actions as a toolset within the open innovation approach (M1)	Providing a structured way to increase the chances of success for open innovation in SMEs (O1)

* The letter 'C' relates to Context; 'I' to Interaction; 'M' to Mechanism and 'O' to Outcome.

The first design proposition shows the format using CIMO-logic that will be followed to develop all subsequent propositions. It addresses Context, Interaction, Mechanism and Outcome. There is, however, one construct missing to fully describe the design proposition and that is the notion of open innovation maturity as a differentiator for knowing which interactions are applicable for the SME to consider.

7.3 Open Innovation Maturity

One of the functional requirements defined for the open innovation approach in chapter 5 read as follows:

> *F10: The approach should consider the innovation maturity level of the organisation.*

Innovation maturity refers to how developed an organisation is in its innovation management and execution. The literature on open innovation maturity is sparse, not just for SMEs, but also for larger organisations.

Flynn and Wang (2012) proposed an open innovation model as adapted from Chesbrough, consisting of six 'types' grouped into three categories. These categories are:

- Minimal innovation and IP efforts made
- Open innovation and IP efforts in place
- Open innovation as integral part of the business model

A case describing open innovation maturity in a technology SME (Brunswicker & Van de Vrande, 2014; Brunswicker & Ehrenmann, 2013), provided the following 'phases' of maturity:

- R&D Collaboration with limited open innovation structures
- Innovation Ecosystem with wider systematic exploitation of value network
- Standardisation and IT Support where standards and open innovation structure are in place together with the required IT systems
- Optimisation and Self-organisation where continuous improvement and self-organisation of open innovation efforts take place together with business model adaption

Enkel et al. (2011) also suggested an open innovation framework, albeit focused on large organisations with the following attributes:

- Maturity level 1: Initial/arbitrary – opportunities arise almost 'accidentally' and are very informal in nature, often once-off events. Protective Legal and IP system.
- Maturity level 2: Repeatable – still mostly informal activities, but repeat partnerships start to occur. Some informal assessments and screening are being performed. Strict IP and Legal conditions. Low level of performance monitoring.
- Maturity level 3: Defined – a written OI strategy is created and targets are set accordingly, with OI Champions also being appointed. Partnerships are becoming more formal and more diverse, expanding the OI network. Trust-based Legal and IP attitude. Centralised reporting and interdepartmental knowledge sharing, absorption of knowledge encouraged, budget available.
- Maturity level 4: Managed – OI strategy encouraged and driven by management, targets are set and formally communicated, Champions rewarded against OI targets, and scouts assigned. Intensity of partnerships increases and partner platforms are used to manage the relationships. Diverse partners and network expansion. Long-term view of Legal and IP. Structural budget and project management practices.
- Maturity level 5: Optimising – strong management focus, OI-based assessments and target adjustments. Initiative-taking in whole organisation and strong focus on external opportunities. Standardisation and specifications in place, partner satisfaction monitoring, strong diversity along value chain and strong inter-network linkages. OI integrated in budget, knowledge exploited in products, win-win contracts and network facilities.

Furthermore, MacKinven et al. (2014) provided a three-level maturity model for external searching open innovation based on a synthesis of the literature and categorised it into Basic, Intermediate and

Advanced levels. It showed the transition from limited, ad hoc search without a directive to a focused, strategy-driven search where search activities are formal functions within the organisation.

The research and consulting firm Forrester (Mattes, 2012) proposed four stages of open innovation maturity, also from a large organisation perspective. They described the stages as:

- Stage I: Experimentation. This stage is characterised by initiatives driven by single Business Units, by a project-based resource allocation and by pilot runs with selected new open approaches to innovation.
- Stage II: Commitment. The second stage is achieved, when there is management support for open innovation, formal resources are reserved for open innovation, the first steps towards organisational embedding are taken and preliminary cost-benefit analyses are done.
- Stage III: Sustainable state. This stage is characterised by a management-level mandate for open innovation, significant formal resources allocated to open innovation, solid cost-benefit analyses in place and continuous use of new open approaches to innovation.
- Stage IV: Full integration. Forrester and the experts of the innovation-3 network characterised the final stage of open innovation maturity by the traits of Stage III plus cultural embedding of open innovation, well-defined and well-managed innovation networks, seamless integration of Enterprise 2.0 and open innovation and Shareholder Value justification of the investment in open innovation.

It is clear from the literature that there is no unified maturity framework for open innovation, especially in the context of SMEs. There are, however, consistent themes emerging from the various maturity descriptions. Maturity levels include an initial, rudimentary level of open innovation use and activities, followed by an interim transitional state where formalisation occurs and ends with a strong level of maturity that reflects formal disciplines. Open innovation as a chosen innovation approach also moves from being ad hoc and optional towards being the dominant approach used in the organisation. This is normally driven by stronger management support and an innovation strategy linked to the organisational strategy. More mature organisations develop enablers such as culture and skills through focused initiatives driven by feedback received from performance measurement practices and improvement efforts. The active management of innovation partners and networks also becomes more important as maturity and capability increase.

The author therefore decided to use a maturity scale appropriate to the study, bearing in mind the scarce literature on this topic and considering the context within which SMEs operate. For this study, three levels of maturity were used to describe the depth and breadth of open innovation within an organisation. This sufficiently captured the broad strokes of differences in maturity practices for SMEs, while not introducing unnecessary complexity in the application of the maturity levels within the design propositions. The innovation maturity levels used for this study are described as follows:

> *Limited* – Open innovation is transactional, once-off events without deep partnerships being built. Organisational enabling factors are limited and open innovation is not the dominant innovation method in the organisation. Open innovation projects are sporadic and reactive, rather than planned and deliberate.
>
> *Transitional* – Open innovation is becoming more prevalent and deeper partnerships and/or wider networks are being established. Open innovation projects are much more strategic and tied to the organisation's strategy. Most organisational enablement factors are established,

and innovation performance is measured as input for continuous improvement of the open innovation capability.

Developed – Open innovation is the dominant innovation method in the organisation, with an established process being followed. The organisation is actively looking for opportunities to engage in open innovation, aligned to their organisational and innovation strategies. Trusted partnerships and innovation networks have been built. All organisational enablement factors are purposefully optimised.

Maturity in terms of design propositions using the CIMO-logic can be viewed as a context type. The innovation maturity gives context to the organisational environment in which the interactions need to take place. The conundrum, however, is that the same interventions might be applicable in different maturity contexts. Interactions are not necessarily mutually exclusive. If the design propositions therefore differentiate based on maturity context, then it may cause propositions where interactions are listed more than once as per the example below.

TABLE 7-2: LOW MATURITY EXAMPLE

Context	Interaction
Search strategies for companies of *low* innovation maturity	Can include • Customer and supplier search • Networking

TABLE 7-3: HIGH MATURITY EXAMPLE

Context	Interaction
Search strategies for companies of *high* innovation maturity	Can include • Customer and supplier search • Networking • Making use of Intermediaries • University partnerships

Keeping in mind the following user requirement (User Requirement 3 from chapter 5) which states,

UR3: The approach should be user-friendly – i.e. easy to adopt, understandable, and easy to use,

it was decided to find an alternative method of indicating maturity applicability. Within this study, the acronyms L (Limited), T (Transitional), and D (Developed) were added to the interactions to indicate the maturity context, where applicable. This should be seen as an indication of the most applicable maturity context within which the interactions can be applied, but should not be considered as a definitive rule. As with all design propositions, the maturity context serves as a guideline to users who still need to make decisions most appropriate to their organisational context and constraints (see also User Requirement 2 and Functional Requirement 9 from chapter 5).

Using our previous example, a design proposition including maturity context might therefore look as follows:

TABLE 7-4: MATURITY LEVELS EXAMPLE

Context	Interaction	Maturity Context
Search strategies for companies	Can include • Customer and supplier search • Networking • Making use of Intermediaries • University partnerships	 L, T, D T, D D D

The following section will focus on using the CIMO-logic in a tabular form, together with the maturity level indicators and following the OIL Framework as structure, to developed further design propositions through the process of abstraction from the literature. For space consideration, the maturity indicator will be shown in the Interaction column, together with the Interaction ID. It will only be shown if maturity is relevant since some interactions may be applicable to all levels or not maturity dependent.

7.4 Developing Design Propositions

Design proposition 1 developed in section 1 above, shows the design proposition and CIMO-logic on the highest level of abstraction and comprises a one-to-one relationship. Flowing from this highest level context is then the framed context within the OIL Framework. The four main phases in the framework as defined in chapter 6 are:

- Plan and Prepare for Open Innovation
- Perform Open Innovation
- Measure and Evaluate Open Innovation
- Improve and Mature Open Innovation

These four main phases will each form another level of 'context' that can be developed into design propositions. Within the main phases, the OIL Framework also suggests 23 core elements in chapter 6, to be considered when performing open innovation. These core elements associated with each phase therefore become the 'interactions' to be considered. There is, therefore, a cascading effect that takes place in the development of the design propositions following the OIL Framework phases and elements. The subcomponents for the phases will form the mechanism within the design proposition.

Using the first of the main phases and its underlying core elements, we can therefore construct the second design proposition. The first OIL Framework phase is 'plan and prepare for open innovation' and has 7 associated phase elements, starting with open innovation strategy and ending with enabling factors. Design proposition 2 therefore has as its context being in the 'plan and prepare for open innovation' phase of the OIL Framework and as interaction the 7 elements from that phase that need to be considered. The subcomponent for the first phase was defined as organisational enablement, which will form the mechanism for the proposition which requires strategic management and policy decisions together with organisational interventions to enable and set up the organisation for open innovation.

TABLE 7-5: DESIGN PROPOSITION 2

Context	Interaction	Mechanism	Outcome
When in the 'plan and prepare for OI' phase of the OIL framework (C2)	Consider the following: • Open innovation strategy (I2.1) • Open innovation culture (I2.2) • Open innovation information and knowledge (I2.3) • Intellectual property management (I2.4) • Organisational structure (I2.5) • Open innovation development process (I2.6) • Enabling factors (I2.7)	Aiding organisational enablement (M2) through strategic management decisions, policy decisions and organisational interventions	Thereby setting the organisation up for OI readiness (O2) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)

Continuing from Design Proposition 2, three more design propositions can be developed addressing the main OIL Framework phases as context and their associated OIL Framework elements as the interactions to consider.

The second OIL Framework phase is the perform OI phase with 6 elements. Development of new innovations take place following a structured open innovation process delivering new products and services in an open way.

TABLE 7-6: DESIGN PROPOSITION 3

Context	Interaction	Mechanism	Outcome
When in the 'perform OI' phase of the OIL framework (C3)	Consider the following: • Opportunities Discovery and ideation (I3.1) • Conceptualisation and selection (I3.2) • Development and portfolio (I3.3) • Management (I3.4) • Deployment and protection (I3.5) • Improvement and exploitation (I3.6)	Embedded in a structured open innovation process (M3) to develop new product and service innovations	Delivering OI in the organisation (O3) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)

In the evaluate open innovation phase, the open innovation performance of the organisation is measured through key performance indicators to identify opportunities for improvement.

TABLE 7-7: DESIGN PROPOSITION 4

Context	Interaction	Mechanism	Outcome
When in the 'measure and evaluate OI' phase of the OIL framework (C4)	Consider the following: • Innovation KPIs (I4.1) • Innovation reviews and learning (I4.2)	Through the measurement (M4) and evaluation of formal performance indicators to obtain insights and learnings	Performance measures to track how well the organisation is implementing and executing OI and where it needs to improve (O4), together with providing a structured way to increase the chances of success for open innovation in SMEs (O1)

The last OIL Framework phase draws from the learning in the previous phase to develop improvement options for any of the previous phases that can then be chosen for implementation and adoption in the organisation based on strategic decisions, resource availability and open innovation maturity aspirations.

TABLE 7-8: DESIGN PROPOSITION 5

Context	Interaction	Mechanism	Outcome
When in the 'improve and mature OI' phase of the OIL framework (C5)	Consider the following: • Organisation (I5.1) • Process (I5.2) • Measurement (I5.3)	Requiring the selection of continuous improvement options and adoption of changes into the organisation (M5)	Resulting in increased OI maturity in the organisation (O5) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)

The first five design propositions are therefore a cascading of the OIL Framework phases and elements. They position the starting point and boundaries of the design propositions, with the OIL Framework as foundation.

Leading on from these initial high-level design propositions, the OIL Framework phases are further unpacked through examining literature associated with each phase topic as input into further possible design propositions. This is done through a detailed systematic review and synthesis of the literature on open innovation and business management methods for each OIL Framework phase and component. As with the cascading of the first 5 design propositions, the interactions (or elements in the OIL Framework) now become the context in the following design propositions and break down the elements into further detail.

7.4.1 Plan and Prepare for OI: Design Propositions

The literature is clear on the importance of a well set-up organisation geared and aligned towards the execution of open innovation (Golightly et al., 2012; Igartua et al., 2010; Almquist et al., 2013). Brunswicker and Vanhaverbeke (2014) suggested that the "performance impact of openness" is influenced by the internal organisational practices applied. It is therefore important to allocate sufficient attention to the factors of open innovation contained in the 'Plan and Prepare for OI' component of the OIL Framework. Setting up a structure within which to innovate can assist resource-constrained SMEs to take on more ambitious open innovation projects, through the use of formal tools and techniques which they might otherwise not have exploited (Almquist et al., 2013). The 'Plan and Prepare for OI' component covers setting up the organisation for open innovation execution. The OIL Framework proposes the following elements to be considered:

- Open Innovation Strategy (I2.1)
- Open Innovation Culture (I2.2)
- Open Innovation Information and Knowledge (I2.3)
- Intellectual Property Management (I2.4)
- Organisational Structure (I2.5)
- Open Innovation Development Process (I2.6)
- Enabling Factors (I2.7)

7.4.1.1 Open Innovation Strategy

The consequence of adopting an open innovation strategy is that the organisation will have to "establish the necessary organisational structures and processes and develop the relevant capabilities for this strategy" (Giannopoulou et al., 2011). The strategy decision should therefore not be taken lightly and management should understand the impact this decision will have on the organisation. Deciding on an appropriate open innovation strategy becomes the first step in moving the organisation from closed to open. Almquist et al. (2013) suggested that innovation strategy is an even more important factor for innovation success than developing innovative ideas.

The organisation needs to determine its strategic drivers and capabilities and then make a decision on how to support this through open innovation (Vanhaverbeke, 2013). "Companies engage in open innovation to create value for customers in new ways and to create a more profitable business" (Vanhaverbeke et al., 2012). Open innovation is not limited to the development of new products "but also for innovating and improving services, processes, technologies, management practices, ideas/concepts, strategies, and business models, regardless of the industry" (Vanhaverbeke, 2013). The SME needs to decide what the innovation goals are, aligned to the business strategy and how it will manage investment priorities and risk (Almquist et al., 2013).

In larger organisations, innovation goals might take on the form of an innovation portfolio encompassing a range of innovation initiatives, including incremental, sustaining and radical innovation (Flynn & Wang, 2012; Almquist et al., 2013; Minderhoud, 2012). The reality for SMEs, however, is that most SMEs don't have the resources to sustain an expansive innovation portfolio due to capacity and resource constraints. SMEs would normally not have more than a handful of innovation initiatives on the go at any given time. That being said, however, as the SME grows, it will become important to mature this innovation management practice to have a more formalised innovation portfolio, since the number and complexity of innovation initiatives will increase. It is also important to understand what types of innovation are being worked on in the organisation, so as not to fall into the ‘trap’ of only focusing on incremental innovation which may not be sufficient to stay competitive over the long term.

The design proposition pertaining to open innovation strategy can therefore be developed as follows:

TABLE 7-9: DESIGN PROPOSITION 6

Context	Interaction	Mechanism	Outcome
When developing an open innovation strategy (C6)	Decide on innovation goals aligned to business strategy (I6.1; L,T,D) and obtain an innovation portfolio view (I6.2; T,D)	Managing and balancing investment and risk (M6)	Providing a view of the innovation which will be developed (O6)

After deciding on innovation goals and priorities, the SME must plan how it will leverage open innovation to achieve those goals.

One of the key strategic choices an organisation needs to make is whether they will follow an inbound (outside-in exploration), outbound (inside-out exploitation) or coupled approach to open innovation (Giannopoulou et al., 2011; Gassmann & Enkel, 2004). Gassmann and Enkel (2004) describe these three strategic choices as follows:

- The outside-in process: Enriching a company’s own knowledge base through the integration of suppliers, customers, and external knowledge sourcing can increase a company’s innovativeness.
- The inside-out process: The external exploitation of ideas in different markets, selling IP and multiplying technology by channelling ideas to the external environment.
- The coupled process: Linking outside-in and inside-out by working in alliances with complementary companies during which give and take are crucial for success. Consequent thinking along the whole value chain and new business models enable this core process.

It is therefore a strategic choice of the SME to reach its innovation goals by bringing external knowledge and technologies into the organisation, or taking knowledge and technologies outside the organisational boundaries, or combining the approaches across the innovation value chain. Knowing what your innovation goals are and what your internal capabilities and shortcomings are (Brunswicker & Vanhaverbeke, 2014; Manceau, 2011), will help guide this decision. It is advisable to open up only where the organisation lacks internal capabilities, making a conscious decision on where to incorporate open innovation (Mattes, 2011). The need might be for complementary technologies, products or services, access to supply chain networks or markets, etc., which might not be accessible to the SME without incorporating open innovation options (Gay, 2014). Boudreau and Lakhani (2009) recommended opening up innovation “when the technology, design and innovation approaches have yet to be established or when customer needs are highly varied or not yet fully understood”, thereby gaining from external knowledge not available internally to the organisation.

Deciding on which open innovation process to pursue will therefore be organisation-specific, based on the specific internal capabilities and innovation goals. It might also be that the organisation selects one primary process and then integrates some elements of the other processes as required (Gassmann & Enkel, 2004).

Gassmann and Enkel (2004) also described three capabilities required to effectively implement the three open innovation approaches.

- Absorptive Capability related to the Outside-in Process: It is important for the SME to have sufficient capacity and resources to efficiently incorporate external knowledge and technologies obtained through the outside-in process into the organisation's innovation process. Absorptive capability (or capacity) relates to the "ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990).
- Multiplicative Capability related to Inside-out Process: An organisation needs to be able to transfer its knowledge and technologies to the environment outside of its own boundaries to exploit it. "The capability to multiply innovation by external exploitation is strongly connected to firm's knowledge transfer capability and the selection of appropriate partners" (Gassmann & Enkel, 2004). The commercialisation of knowledge and technology will only be successful if the SME can transfer it to the external entity in a format that it can be absorbed. Also, the "strategic selection of partners that are willing and able to multiply the new technology is an important element of the multiplicative capability of the firm" (Gassmann & Enkel, 2004).
- Relational Capacity related to Coupled Process: Relational capacity is the competitive advantage an organisation obtains through its ability to establish and maintain relationships "to enable joint development in strategic alliances" (Gassmann & Enkel, 2004). The combination of an organisation's innovation network therefore becomes a differentiator and strategic asset, influencing not only the alliances and joint venture options available to it, but also the business model which can be employed (Gay, 2014).

Flowing from the literature discussed above, the next design proposition is as follows:

TABLE 7-10: DESIGN PROPOSITION 7

Context	Interaction	Mechanism	Outcome
When selecting an open innovation approach (C7)	Decide between an inbound (I7.1; L,T,D), outbound (I7.2; L,T,D), or coupled process (I7.3; T,D)	Drawing from your absorptive (M7.1), multiplicative (M7.2) and relational (M7.3) capacities	Showing where the organisation will open up its innovation process (O7)

Once the open innovation process has been decided, the SME must select the mode(s) (Chesbrough & Brunswicker, 2013) or methods of open innovation which will be used within the open innovation process. Various methods exist for ideas, knowledge and technologies to be brought into or taken outside of the organisation (Mattes, 2011; Chesbrough & Brunswicker, 2013; OPINET, 2011).

For inbound open innovation, the following methods can be considered:

- IP in-licensing or acquisition

- Contracted R&D
- Idea and start-up competitions
- Supplier innovation
- Crowdsourcing
- Customer co-creation
- Informal or formal networking
- Joint ventures or alliances
- Customer immersion

For outbound innovation, the following methods can be considered:

- Spin-offs
- IP out-licensing or selling
- Corporate business incubation
- Joint ventures or alliances

It is also important to consider the source(s) or partner(s) for open innovation (Mattes, 2011; OPINET, 2011; Brunswicker, 2011; Vahter et al., 2012). Open innovation can be done with:

- Direct or indirect customers
- Suppliers
- Competitor or non-competitor organisations
- Academic and research institutions
- Intermediaries
- Lead users
- Innovation networks
- Innovation scouts
- Science/innovation hubs
- Government development agencies
- Consultants

Deciding who to innovate with is an important factor for open innovation success as these relationships will have to be managed by the SME (Vanhaverbeke et al., 2012). The SME can decide to either have numerous innovation partners, focusing on innovation breadth, or to have limited partners, but establishing deep relationships with them (innovation depth) (Vahter et al., 2012). Vahter et al. (2012) however cautioned SMEs against having too many partners, since it will place strain on the SME to effectively manage them all. They recommended a maximum of four types of innovation partners, since their research showed that innovation performance starts to decline when exceeding this number. This further suggests the importance of choosing the "most appropriate or beneficial innovation partners" (Vahter et al., 2012). Given the resource constraints of SMEs to invest in finding the appropriate innovation partners, Lee et al. (2010) suggested making use of intermediaries to overcome this barrier. Innovation intermediaries can provide expertise and resources not available to SMEs to assist with open innovation.

Research found that SMEs prefer to use less resource-intensive open innovation practices such as informal networking and customer and employee involvement rather than intensive practices such as IP licensing or venturing (OPINET, 2011; Vahter et al., 2012; Van de Vrande et al., 2008). This was also found in the research on South African SMEs as discussed in chapter 4. Already established relationships are exploited first, rather than establishing new ones which will require additional resource effort from the SME (OPINET, 2011). More complex and resource-intensive practices will require a mature open innovation environment to succeed. Manceau et al. (2011) identified three partner approaches:

- Topic-orientated: organisations search for the most competent partner to solve specific innovation problems. Previous relationships with these partners are not important. The focus is purely on finding a partner with the best competences and solutions to solve the problem.
- Partner-orientated: organisations innovate with partners with whom they have connected before. A trusted relationship exists and projects are derived based on mutual expertise and capabilities, rather than specific topics.
- Open-orientated: organisations welcome any ideas from any partner. Innovation partnerships are not partner- or topic-biased and need not be in line with current strategic priorities.

Given the SME preferences mentioned earlier, the author would suggest one more variant to the three partner approaches presented by Manceau et al. (2011).

- Immediacy-orientated: organisations innovate with known partners within their immediate network where connections have already been established to solve specific and defined innovation problems.

The following design proposition is derived:

TABLE 7-11: DESIGN PROPOSITION 8

Context	Interaction	Mechanism	Outcome
For open innovation method and partner selection (C8)	Decide on the open innovation method(s) (I8.1) aligned with the chosen open innovation approach (I7). Select the appropriate partner orientation: • Immediacy (I8.2; L,T) • Topic (I8.3; T, D) • Partner (I8.4; T,D) • Open (I8.5; D) and Select the appropriate innovation partners (I8.6)	Considering innovation depth (M8.1), breadth (M8.2) and intensity (M8.3)	Establishing a partner and network management landscape (O8)

7.4.1.2 Open Innovation Culture

Peter Drucker is famously attributed to having said that "culture eats strategy for breakfast". Changing the culture of the organisation to embrace openness is a key step towards the successful implementation and execution of open innovation (Golightly et al., 2012; Mortara et al., 2009; West

& Bogers, 2014). A different organisational culture – defined as "a system of behavioural norms and values as well as firmly held beliefs" (Wagner & Piller, 2012) – is needed where open innovation is practiced, embracing ideas and collaboration from outside of the organisation, versus a closed organisation where innovation is an internal undertaking (West & Bogers, 2014; Giannopoulou et al., 2011).

A key success factor for driving and adopting an open innovation culture, is the direct involvement and support from top management (Giannopoulou et al., 2011; Mortara et al., 2009; Spitzley & Schweinfort, 2007). Research by Spitzley and Schweinfort (2007) showed that SMEs consider "Courage of the company's management for new ventures" as a highly important success factor for innovation capability. Management must provide a clear mandate that entrepreneurial risk-taking and accessing external innovation is encouraged. Employees must know that "sourcing external innovation does not compete (with) nor substitute internal activities" (Giannopoulou et al., 2011). External and internal innovation should be combined to provide the best solution to the given innovation problem.

Commitment to open innovation should not be seen as a singular event. Long-term support through investment of resources, time and budget is required to embed a new open innovation culture in the organisation. Views must be shifted from a resistance to 'not-invented-here' innovations, to one of embracing ideas and technologies found elsewhere (Mortara et al., 2009).

Unlike with larger organisations where centralised open innovation teams are often established to direct the change process from closed to open (Mortara et al., 2009), SMEs are normally more limited in their employee numbers and making use of large dedicated teams will normally not be an option. Change will have to be owned by top management – which often only consists of the founder/owner of the organisation. Change is therefore much more localised in nature.

Continued, clear communication from leadership is also important to sustain the culture change process (De Jong et al., 2013). The vision, strategy and plan of how open innovation will be implemented and executed must be shared with all involved. Employees must know what is expected of them and how they will be supported during this change. Sharing of success stories is also an effective communication method to convince employees of the benefits of open innovation (Manceau et al., 2011).

The ninth proposition is defined as follows.

TABLE 7-12: DESIGN PROPOSITION 9

Context	Interaction	Mechanism	Outcome
When changing the innovation culture to be more open (C9)	Drive change through clear top management commitment, communication, and involvement (I9.1)	Moving from a 'not-invented-here' to a 'proudly-found-elsewhere' paradigm (M9.1)	Creating a safe and open innovation culture (O9)

7.4.1.3 Open Innovation Information and Knowledge

Open innovation inevitably leads to new knowledge to be managed within the organisation. Whether in the form of ideas, technology information, patents, partnership information, communication artefacts or other variations of information and knowledge flowing through the organisation, it will have to be managed. Knowledge management can be defined as "identifying, translating, sharing, and exploiting the knowledge within an organisation" (Igartua et al., 2010) or "the sum of organisational routines and strategic processes by means of which companies can acquire, assimilate, transform and exploit knowledge" (Wagner & Piller, 2012).

Formal knowledge management practices are often lacking in SMEs (Brunswicker & Van de Vrande, 2014), reducing the potential value of knowledge in the organisation. Lichtenthaler and Lichtenthaler (2009) proposed various knowledge 'capacities' required within an organisation from an open innovation perspective (Table 7-13).

TABLE 7-13: KNOWLEDGE PERSPECTIVES

Knowledge	Exploration	Retention	Exploitation
Internal	Generate new knowledge inside the firm	Maintaining and re-activating knowledge in a firm's knowledge base	Transmuting knowledge and converting this knowledge into new products or services
External	Knowledge acquisition	Maintaining and re-activating knowledge in inter-organisational relationships	Identifying external knowledge exploitation opportunities and subsequently transferring the knowledge to the recipient

Drawing from various literature sources, they constructed the knowledge capacities into an internal and external perspective based on knowledge exploration, retention and exploitation. The framework should however be seen as a continuum, instead of absolute instances.

The use of information technology is an enabler of knowledge management (West & Bogers, 2014; Bianchi et al., 2011). The more complex and distributed knowledge becomes, the more important it is to leverage technology in its management. Using technology, SMEs can search for new external innovation, obtain ideas through crowdsourcing, and tap into online communities (West & Bogers, 2014). Innovation collaboration tools facilitate knowledge-sharing with external partners such as customers, suppliers or research institutes, as well as internally between employees. Innovation ideas can be made visible to all role players and connected with other platforms such as social networking, wikis, project management and relationship management tools (Brunswicker & Ehrenmann, 2013; Karlsson, 2010).

This leads us to the following design proposition.

TABLE 7-14: DESIGN PROPOSITION 10

Context	Interaction	Mechanism	Outcome
When managing knowledge during innovation (C10)	Establish formal practices to manage complex and distributed knowledge internal and external to the organisation	Through the configuration of knowledge capacities (M10.1) and collaborative	For effective knowledge utilisation (O10)

Context	Interaction	Mechanism	Outcome
	(I10.1), leveraging technology to simplify this task and to connect to other complementary organisational platforms (I10.2; T,D)	technology platforms (M10.2)	

7.4.1.4 Intellectual Property Management

When knowledge is shared across organisational boundaries, it has implications for how the intellectual property (IP) of that knowledge is managed and protected. Intellectual property management is a key consideration when embarking on open innovation (Brunswicker, 2009) even though the study of South African SMEs in chapter 5 showed a lesser concern with IP rights. The laws around IP rights, although similar across the world, may have specific nuances in interpretation and application depending on the country whose jurisdiction it is being used in. It is therefore highly recommended that sound legal advice is obtained when making decisions on IP management when practicing open innovation.

Making uninformed decisions regarding how to manage IP can be costly, especially for SMEs. It can become costly to pay for things like patent registrations, maintaining them and defending any infringements, especially in more than one country or against larger organisations (Brunswicker & Van de Vrande, 2014; Vanhaverbeke et al., 2012; CEIN et al., 2012). On the other hand, however, if a collaboration partner appropriates all the value from your IP without you being compensated for it, then your organisation can suffer serious losses. It is therefore important to establish a clear IP strategy for the organisation.

Various IP protection mechanisms can be used by SMEs. These may include (CEIN et al., 2012)

- Patents
- Utility Models
- Trademarks
- Trade Names
- Industrial Design
- Business Secrets
- Copyrights

The appropriate IP mechanism must be chosen depending on the open innovation strategy the organisation embarks on, as well as the type of knowledge being protected. Research by Vanhaverbeke et al. (2012) suggests that strategies such as co-patenting are not preferable for SMEs, since the shared attribution of value to the co-development partners involved can be very complex and, as mentioned, difficult to defend in legal cases. SMEs tend to "make clear agreements up front about who owns the patent and how innovation partners can use the technology through specific licensing agreements" (Vanhaverbeke et al., 2012). Some SMEs even prefer informal IP protection mechanisms, such as speed to market or secrecy (Brunswicker & Van de Vrande, 2014) rather than more complex and expensive formal IP protection.

For collaborations with larger corporations, however, having formal IP mechanisms such as patents in place may be a requirement before they will be willing to do business together (Brunswicker & Van de Vrande, 2014). This is understandable, since it protects both parties involved with a clear understanding as to who owns any IP rights before knowledge-sharing takes place. Formal IP rights mechanisms can therefore act as a facilitator of knowledge-sharing within collaborations (Alexy et al., 2009).

IP planning must consider three collaboration periods (CEIN et al., 2012; Mehlman et al., 2010), being:

- Pre-collaboration or exploration phase
- Collaboration or co-development phase
- Post collaboration or commercialisation phase

Different agreements might be appropriate during each of these periods such as non-disclosure agreements, material transfer agreements, alliance agreements, and licencing agreements (Mehlman et al., 2010). It is advisable that agreements are in place before commencement of the specific phases to avoid any possible knowledge ownership issues later on (Giannopoulou et al., 2011; Mehlman et al., 2010).

Open innovation has brought about a shift in which organisations look less to keep their own IP exclusively, but to create models where value can be appropriated through methods such as exclusive or non-exclusive licensing, royalties or co-owned IP and acquisition. It is therefore crucial that all the partners involved are clear on their IP position, responsibilities and rights (Golightly et al., 2012).

For IP management, the following design proposition is developed.

TABLE 7-15: DESIGN PROPOSITION 11

Context	Interaction	Mechanism	Outcome
Intellectual property management requires (C11)	Setting up an IP framework for the organisation to clarify its intended use of protection mechanisms (I11.1) and to establish appropriate agreements with collaboration partners (I11.2; T,D)	Assisted by sound advice from IP experts on the different IP mechanisms available (M11.1), such as patents, trademarks, trade secrets, and copyright	Ensuring clearly assigned and protected IP (O11)

7.4.1.5 Organisational Structure and Networks

Changing the way the organisation innovates and opens up its boundaries to allow for the inflow and/or outflow of ideas, knowledge and technology, requires a change in how the organisation is structured. This includes roles and responsibilities, functional structures and team set-up. It also extends into how the organisation's internal and external innovation networks are managed (Flynn & Wang, 2012). These changes can be particularly challenging for SMEs, however, given their limited number of employees and other resources (Vahter et al., 2012).

Two organisational structure recommendations from the literature for open innovation implementation were establishing a matrix structure and making use of a centralised open innovation team which takes responsibility for rolling out open innovation policies, processes and tools (Flynn & Wang, 2012; Golightly et al., 2012; Mortara et al., 2009). For large organisations this is sound advice, but for SMEs it poses a substantial challenge due to resource constraints. Medium-sized organisations towards the upper-size scale could consider this approach for their open innovation implementation, but smaller organisations with only a few employees will need an alternative approach.

The first step is to consider the different roles and responsibilities required for open innovation. Flynn and Wang (2012) proposed four roles of External Broker, Internal Broker, Champion and Scout.

- External Brokers act as mediators between an enterprise and the outside world. These players are critical to developing and maintaining strong relationships across functional groups, particularly between technical groups and business-focused units.
- Internal Brokers have a vast reach across different areas of the company and facilitate the exchange of information and assets across the company. In contrast to External Brokers, Internal Brokers operate as mediators across functions and business units within the enterprise.
- Scouts are managers and senior technical experts working from inside the company, to identify future trends, needs and technologies outside of the company. They usually collaborate with a network of peers (internal and external) who are globally dispersed, in order to share their ideas and thoughts.
- Champions are senior leaders, usually executives, who own an overall portfolio of innovation initiatives. They determine the right mix of projects to be undertaken within their portfolio. They are responsible for executing collaboration with external resources once external assets have been identified and evaluated within the company.

Further responsibilities include providing oversight and coordination of open innovation activities, establishing governance, developing tools and processes, assisting with expert advice, managing strategic linkages, running innovation challenges and providing training (Flynn & Wang, 2012; Golightly et al., 2012; Mortara et al., 2009).

Another key responsibility under open innovation is the management of innovation partner and network relationships. Every in- or outflow of knowledge will require a relationship to be established with one or more partners in the innovation network to enable this flow (Chiaroni et al., 2011). These relationships may be in the form of weak or strong ties, depending on the type of interaction required. Brunswicker and Ehrenmann (2013) submitted that “strong ties foster knowledge transfer, transactions, and joint innovations” whereas weak ties “facilitate the identification of new trends, innovation potentials and opportunities”. Strong ties suggest more intensive knowledge exchange whereas weak ties will facilitate lesser knowledge exchange (Van de Vrande et al., 2008). Strong ties will also necessitate more effort to manage the relationship and knowledge flow, impacting more heavily on the SME’s resources. The relationships required will be dependent on the chosen open innovation strategy, the innovation maturity of the organisation and the type of innovation being developed. SMEs must choose innovation partners that will meet their needs in the most efficient way (Manceau, 2011).

Given the resource constraints within SMEs, Vahter et al. (2012) proposed utilising brokering intermediaries to identify external innovation partners and to provide support in developing the required relationships. Less-mature SMEs will however most likely engage with existing partners first because it will generally require less effort (Manceau, 2011; OPINET, 2011).

Organisational design impact might be as little as different roles being assigned to employees or on a larger scale, requiring expanding into new business unit structures developed to support the open innovation initiatives in the organisation (Almquist et al., 2013). Establishing and nurturing internal and external innovation networks will also be an essential requirement (Chiaroni et al., 2011).

TABLE 7-16: DESIGN PROPOSITION 12

Context	Interaction	Mechanism	Outcome
The impact on organisational structures and networks will require (C12)	Assigning new roles (I12.1; L,T,D) and possible new structures (12.2; T,D) supportive of open innovation, and establishing and nurturing internal and external innovation networks (I12.3; L,T,D)	Providing responsibilities and mandates to execute open innovation (M12.1) and manage partner/innovator relationships	Resulting in an open organisational structure and innovation network (O12)

7.4.1.6 Open Innovation Development Process

Knowing how to perform open innovation is something that must be learnt, just like any other business skill. Employees can't be expected to miraculously move from a closed to an open innovation mind-set by themselves. Some form of learning intervention will be required to build the required innovation skills and capacitate the roles for innovation (Flynn & Wang, 2012; Kirchgeorg et al., 2010). Employees must be familiarised with new innovation policies and procedures, role requirements and the open innovation strategy (Kirchgeorg et al., 2010). Mortara et al. (2009) put forward four skills which enabled open innovation in organisations. They are:

- Introspective skills – enabling organisations to assess internal gaps and opportunities
- Extrospective skills – allowing companies to review external capabilities and opportunities and to understand the viewpoint of other organisations
- Interactive skills – communication skills that convey the value of any relationship with the external world to both internal and external participants
- Technical skills – including all the technological, marketing, financial, commercial, management and business skills and tools needed to support the three categories above

It is important for the organisation as a whole to contain these skills and not necessarily that every person in the organisation will have all of these skills (Golightly et al., 2012). It becomes a collective blend of skills (Mortara et al., 2009). For SMEs, this therefore becomes a challenge. Often having only a few employees, this would mean that individuals would need to exhibit more of these skills per person. The overarching principle though, is to "embed a collaborative mindset" (Golightly et al., 2012) and to use this as a guide when identifying the skills learning plan, in line with the open innovation maturity of the organisation.

Training not only develops new skills and knowledge, but also facilitates knowledge flow and shared languages (Manceau, 2011). In addition, it can help with building a new open innovation culture in the organisation (Manceau, 2011) and must therefore be seen as a continuous endeavour.

The design proposition created for innovation development is:

TABLE 7-17: DESIGN PROPOSITION 13

Context	Interaction	Mechanism	Outcome
The process of open innovation development (C13)	Requires the training of new open innovation skills to employees (I13.1; L,T,D)	Being introspective, extrospective, interactive, and technical (M13.1)	Creating a blend of available skills for an organisational open innovation mindset (O13)

7.4.1.7 Enabling Factors

Setting up clear policies which guide open innovation activities can help an organisation with a consistent understanding of what is allowed – and even encouraged – when implementing and executing open innovation. It will direct employees on matters such as collaboration practices and rules of engagement, internal and external communications guidelines (Flynn & Wang, 2012), investment and procurement. Policies need not be prohibiting, but should serve as enabling governance in an organisation to ensure good business practice and clarity on what is accepted in the organisation.

Another important enabler is managing the change process in the organisation. Ebert et al. (2008) states that "leading innovation companies make use of change management principles to move the organisation toward open innovation". The Project Management Institute (Project Management Institute, 2013) proposed the following change management steps as guidelines for project success:

- Formulating the change by formulating and clarifying the need for change, assessing readiness for change, and delineating the scope of change.
- Planning the change by defining the change approach and planning stakeholder engagement as well as transition and integration.
- Implementing the change by preparing the organisation for change, mobilising the stakeholders, and delivering project outputs.
- Managing the change transition by transitioning the outputs into business operations, measuring the adoption rate and the change outcomes and benefits, and adjusting the plan to address discrepancies.
- Sustaining the change on an ongoing basis through communication, consultation, and representation of stakeholders; conducting sense-making activities; and measuring benefits realisation.

Before finally embarking on the execution of open innovation in the organisation, it is prudent to perform a final open innovation readiness assessment. The assessment will help to confirm that the organisation is 'all systems go' and ready to perform the open innovation process. The assessment can be done by answering a few probing questions (OPINET, 2011(b)) in the form of a checklist to make sure that all the areas within the Enablement phase have been considered and appropriately addressed.

Questions to consider are:

- Are you clear on what you want to achieve through open innovation?
- Do you know what value you will bring to the relationship or obtain from your innovation partner?
- Do you have the right internal support and capabilities to innovate in an open way?
- Have you considered IP protection mechanisms, knowing what to share and what to keep secret?
- Do you know where to look for new ideas or to make your own IP visible to others?
- How will you manage your open innovation network/partners/relationships?

If you can answer these questions and have worked through propositions 6 to 13, then you should be in a good position to perform open innovation.

TABLE 7-18: DESIGN PROPOSITION 14

Context	Interaction	Mechanism	Outcome
Open innovation enablement requires enabling factors (C14)	Such as the implementation of clear policies (I14.1), managing change (I14.2), and a final readiness assessment (I14.3)	Strengthening governance (M14.1) and leveraging industry change frameworks (M14.2) and readiness checklists (M14.3)	For an enabling environment to execute open innovation (O14)

7.4.2 Perform OI: Design Propositions

An open innovation process is required to execute open innovation in the organisation based on the open innovation strategy developed during the 'Plan and Prepare' phase and within the structures set up for enablement. The 'Perform OI' component within the OIL Framework proposes the following elements to be considered:

- Opportunities Discovery and Ideation
- Conceptualisation and Selection
- Development and Portfolio Management
- Deployment and Protection
- Improvement and Exploitation

Although the process components are generic from an innovation perspective, it will be important to tailor them to support the given open innovation strategy decided on for the organisation. For instance, the process and related capabilities will be different for inbound versus outbound innovation (Giannopoulou et al; Huizingh, 2011). The innovation process should "help businesses to identify, evaluate, develop, implement and exploit new products and services more efficiently and effectively" (Du Preez & Louw, 2008), all within its own organisational and innovation context.

The overarching design proposition for the 'Perform OI' component was developed earlier in this chapter as follows:

TABLE 7-19: DESIGN PROPOSITION 3

Context	Interaction	Mechanism	Outcome
When in the perform OI phase of the OIL framework (C3)	Consider the following: • Opportunities Discovery and ideation (I3.1) • Conceptualisation and selection (I3.2) • Development and portfolio (I3.3) • Management (I3.4) • Deployment and protection (I3.5) • Improvement and exploitation (I3.6)	Embedded in a structured open innovation process (M3)	Delivering OI in the organisation (O3) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)

This will be used as basis to further define design propositions for the underlying elements.

7.4.2.1 Opportunities Discovery and Ideation

An A.T. Kearney study showed that leading innovation companies devote three times more effort into managing the front end of the innovation process than followers do (Karlsson, 2010). It is important to manage the flow of ideas into the innovation process to support the innovation strategy. The strategy provides guidance (or boundaries) on a high level, but that needs to be translated into specific requirements or innovation needs.

Slowinski and Sagal (2010) defined this as the organisation's 'Wants' in their 'Want, Find, Get, Manage' (WFGM) model. The organisation defines unmet customer needs to be addressed or areas for new products or services. The needs might at this stage be defined up to a level of detail that defines the actual feature or component required, for instance, in a new product, or it might be at a high level describing the need to find new innovation ideas in a specific field.

The SME must, after defining the requirements scope, decide if the organisation wants to open up finding ideas and opportunities to meet those needs outside of the organisation and through which methods. New ideas can be sourced from user communities, running crowdsourcing competitions, having ideation sessions with suppliers and customers or working with scouts or other intermediaries. The main aim at this stage of the innovation process is to be divergent in idea and opportunity identification and development. It is about having many options available that can be filtered and reduced later on.

To motivate external players to participate and contribute to the innovation process, a company can use monetary or non-monetary incentives (West & Bogers, 2014). Monetary incentives can be in the form of direct payment for ideas, prizes in competitions, discounts on services or future products, etc. Non-monetary incentives can be intrinsic motivators such as peer recognition, often seen in open-source development.

Another enabling mechanism is the establishment of a platform with formal tools and processes for participants to produce or submit ideas or innovations (West & Bogers, 2014).

SMEs can make use of platforms such as www.ideas4all.com, www.bigideagroup.net and www.innocentive.com to run idea challenges if they don't have their own idea platforms. Alternatively, idea challenges can be run using company websites or even in-store competitions. They can start with one or two challenges and create awareness among customers on social media such as Facebook and Twitter. Opening up the innovation process therefore need not be too expensive.

It is, however, important to note that the resources required to manage the open innovation process in terms of such things as idea management and filtering, and communication can be intensive and should be planned for carefully (OPINET, 2011(b)). Idea searches can fall within four broad categories (Gassmann, & Enkel, 2004; Phillips, J. 2011). On one axis, we can consider who this request will be directed to and on the other axis, how defined this request will be. The matrix below shows the four quadrants for idea searches using these boundaries. A directed closed network request is the most focused of open innovation search methods. The organisation is very specific about the type of innovation they are looking for (the problem to be solved) and makes use of a selected group of participants to solve the problem. In a directed open search, the solution opportunity is opened up to everyone who wishes to participate, but again the problem is very specific. This method provides targeted solutions to a specific problem, but opens up the pool from which potential solutions may come. In a suggested open network, anyone can submit an idea on any topic they want. The network also rates ideas submitted, providing a way to filter ideas and allow the better ideas to bubble to the top for organisations to consider. Lastly, the suggested closed network allows a select group of participants to suggest any ideas to the organisation for consideration. Sometimes broad categories and guidelines will be provided, but ideas can be very broad.

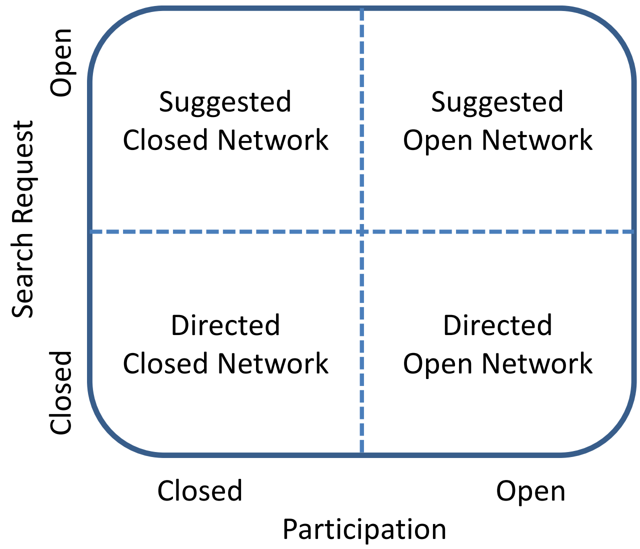


FIGURE 7-2: SEARCH MATRIX

The following design proposition is proposed for Opportunity Discovery and Ideation:

TABLE 7-20: DESIGN PROPOSITION 15

Context	Interaction	Mechanism	Outcome
When performing opportunity discovery and ideation (C15)	Define the needs that will be addressed by the ideas to be sourced (I15.1; L,T,D), select the ideation partners to work with and methods to obtain ideas (I15.2;L,T,D), and run idea campaigns (I15.3;L,T,D)	Using appropriate platforms to capture ideas (M15.1) and incentives to increase participation (M15.2)	Resulting in a pipeline of innovation ideas and opportunities (O15)

7.4.2.2 Conceptualisation and Selection

At this stage of the innovation management process, the SME will have a collection of ideas that need to be converted into concepts. Viable concepts will be promoted for funding and development. A concept is an idea – or combination of ideas – that are developed into a more substantial description or prototype (Du Preez & Louw (2008).

Du Preez and Louw (2008) stated that “more iterative loops may be required between idea generation and concept definition, based on learning obtained through modelling and prototyping”. They further suggested that refinement and testing of the concepts are done to determine feasibility as quickly as possible to mitigate against possible larger losses if the concept is taken further down the development cycle when failure becomes more expensive (Du Preez & Louw (2008). This notion of 'fail fast fail early' is in line with lean start-up thinking by Eric Ries (Ries, 2011) where concepts are tested as early as possible in the development cycle.

Concept development might require input from various employees and even external partners such as suppliers or customers. It is therefore important that ideas are correctly framed and defined to ease communication and understanding (Du Preez & Louw (2008). Obtaining external input might require contracts and licensing to manage the IP transfer taking place (West & Bogers, 2014). External input can be in the form of knowledge or technology (West & Bogers, 2014).

Concepts need to be filtered according to feasibility, but also in line with the organisational and innovation strategies (Brunswicker, 2011; Du Preez & Louw, 2008). Huizingh (2011) suggested using the model from Fetterhoff and Voelkel (2006) to evaluate concepts. “The model distinguishes six assessment dimensions, including company (fit with strategy), customer utility, competition (uniqueness of the opportunity), commerce (market size), capital cost, and copyright (intellectual property)”.

Boudreau and Lakhani (2009) proposed three ‘lenses’ to use for filtering. “The business lens examines the competitive context, prevailing economics, and positioning within the value chain. The market lens uncovers customer preferences—those that can be described and those that can only be discovered through careful observation of behaviour. The technology lens assesses feasibility and often provides benefits that can create and sustain competitive advantage”. They further went on to state that “Insights must be combined to create winning value propositions. All great innovation successes are at the intersection of a customer ‘problem to solve’, an enabling technology that helps solve it, and a business model that enables the innovator to extract value from solving the problem”.

Once concepts have been assessed against the chosen criteria, the organisation is left with a list of innovation projects which will be further funded for development (Du Preez & Louw, 2008).

When concepts are filtered out not to be developed further by the organisation, then these can be transferred into the inside-out open innovation approach where these concepts are taken outside of the organisation to obtain further value from them. Concepts can be spun out into separate businesses, licenced to external parties or be made available as free sharing (such as open-source code).

TABLE 7-21: DESIGN PROPOSITION 16

Context	Interaction	Mechanism	Outcome
Conceptualisation and selection (C16)	Requires the organisation to develop the ideas further into concepts (I16.1; L,T,D) and filter them for further investment and development (I16.2;L,T,D) or value-capturing outside the organisation (I16.3;T,D)	According to a set filtering criteria (M16.1)	For a list of innovation projects to develop (O16)

7.4.2.3 Development and Portfolio Management

During the Development and Portfolio Management stage of the innovation process, the SME will develop concepts into products or services that can be taken to market and commercialised. The organisation should aim to have a portfolio of innovation projects that supports the strategy and organisational goals (Du Preez & Louw, 2008). The project mix should find a balance between metrics such as time, risk and value (De Jong et al., 2013), market growth profile and innovation type (such as incremental, sustaining and disruptive) (Flynn & Wang, 2012).

The aim for the organisation is to balance their innovation portfolio based on their innovation strategy and risk appetite. Having only small incremental innovations in its portfolio might not be a sustainable long-term strategy. Having only radical innovations, on the other hand, might again be very risky if none of them can be successfully commercialised.

For many SMEs, the innovation portfolio may consist of only a few innovation projects due to the limited capacity within the organisation. It is however still important to understand where these projects fall from a portfolio perspective, mapped to the metrics described earlier. It will provide visibility to the organisation which could prompt a change in projects to be worked on, highlight possible sustainability risks and vulnerabilities, or highlight the need for a change in strategy.

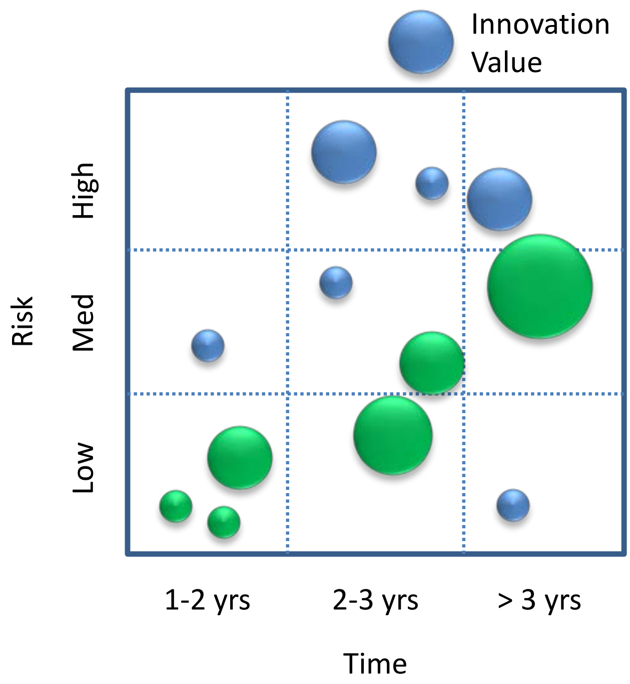


FIGURE 7-3: INNOVATION PORTFOLIO

Having a portfolio view of all innovation projects also assists in more effective project planning with respect to resource allocation, funding, timing of projects and overall alignment between initiatives (Du Preez & Louw, 2008).

Figure 7-3 shows an example of mapping out potential innovation projects within a portfolio against delivery time and risk, together with potential value size. An informed decision can then be taken to pursue the most attractive and strategy aligned projects.

Organisations that opted for a co-development strategy will have additional complexities to deal with during this stage. The organisation will have to manage the network partner(s) and the movement of knowledge between each of them (Slowinski & Sagal, 2010; Gassmann, & Enkel, 2004). There must be clear responsibilities established between the partners and agreement achieved on processes and systems to be used during development. Further considerations would be project management standards to use, reporting dashboards, meeting frequency, method of communication and dispute management.

In recent years, Agile has become a popular management method, especially with smaller firms involved in software development (O'Sheedy, & Sankaran, 2013; Baruah, & Ashima, 2012). Agile allows for early customer validation of products, giving organisations an opportunity to change direction if it becomes clear that customers have different expectations from a product in development or where requirements have changed during development (De Jong et al., 2013). It is also effective where requirements are not clear upfront and flexibility is required during the development process. Other, more traditional project management methods that can be applied are PMBOK and Prince2.

Design proposition number seventeen therefore is defined as:

TABLE 7-22: DESIGN PROPOSITION 17

Context	Interaction	Mechanism	Outcome
During development and portfolio management (C17)	Balance the innovation portfolio according to selected criteria (I17.1; L,T,D) and manage internal (I17.2;L,T,D) and external resources (I17.3;T,D)	Using project management standards such as PMBOK and Agile (M17.1)	To develop products or services that can be commercialised (O17)

7.4.2.4 Deployment and Protection

Once development of the new product or service has been completed, it can be deployed into the market or into the organisation. The deployment approach will be different depending on the open innovation strategy followed (outside-in, inside-out or coupled) and if the innovation will be internally or externally deployed.

Outside-in innovation will be taken to market or deployed into the organisation by the organisation itself. It will require standard deployment practices such as described in the PMBOK (Project Management Institute, 2008) for instance. Consideration should be given to market preparation and communication for the deployment, supplier and manufacturing capacity and operational support and capacity (De Jong et al., 2013).

When following an inside-out approach, then further requirements must be considered. Deployment is not company dependent, but reliance is placed on an external party to take the innovation to market or to utilise it in their business (Chesbrough & Bogers, 2014). Chesbrough and Bogers (2014) stated that "the business model for the idea often will differ from that of the company from which it came, and often the business model must be discovered, in order to take the idea to market". Mechanisms for taking innovations outside of the organisation can be donating IP (revealing), spin-outs, out-licensing and selling of the technology (Piller, & West, 2014; Chesbrough & Bogers, 2014). The SME must package the innovation so that it can be easily consumed by the external party to ensure successful transferring of the IP or technology for use.

When an organisation follows a coupled open innovation approach, they will then follow a combination of the tactics described above. Deployment may involve a co-dependency between the organisation and another delivery partner. The coupled process requires the organisation to "integrate external knowledge and competencies and externalising own knowledge and competencies" (Gassmann, & Enkel, 2004). It is vital to be clear on roles and responsibilities of the individual organisations during this process.

Consideration should also be given regarding the protection of the new innovation after deployment. It is advisable to obtain professional advice regarding this to ensure intellectual property is appropriately protected. Design Proposition 11 addressed the requirement to establish an appropriate IP framework for open innovation. The organisation can follow the IP framework during this stage.

TABLE 7-23: DESIGN PROPOSITION 18

Context	Interaction	Mechanism	Outcome
To deploy an innovation in the market (C18)	The organisation will take sole or joint ownership, depending on the innovation strategy adopted (I18.1; L,T,D) and the innovation protected (I18.2;L,T,D)	Through the adoption of deployment practices (M18.1) and IP frameworks (M18.2)	To achieve successful deployment (O18)

7.4.2.5 Exploitation and Exploration

After a new innovation has been deployed, the organisation can seek to further increase the value appropriated from it by exploitation. The innovation can be improved by adding features or improving on capability or performance. This can then either draw new customers or be sold as an upgrade to existing customers. Another way to extract further value is to consider new markets to introduce the innovation in or create new business models around the innovation (Du Preez & Louw, 2008; Bianchi, 2010). SMEs can furthermore look at capturing value through the use of patents that can be sold or licenced to other firms for the use of the innovation.

Arrigo (2012) highlighted a differentiation between exploitation and exploration[5]. Exploitation is seen as extracting further value from an organisation's "current knowledge, resources, capabilities and relationships" whereas exploration is seen as finding new business opportunities in the form of new customers, channels, markets and technologies.

Finding applications and opportunities outside of the organisation's normal markets and business boundaries can be a challenge for SMEs. Bianchi et al. (2010) noted that this may be due to cognitive boundaries where "the current industry serves as a reference frame for the analysis of new technologies, and hence applications outside it are unlikely to be identified and judged profitable to be pursued". De Jong et al. (2013) encouraged organisations to not "get locked into a narrow conception of your business model" and to explore new profit pool opportunities through alternative delivery channels and customer markets.

A word of caution was however also provided that "cross-sectorial technology commercialisation requires a multidisciplinary competence basis" (Bianchi et al., 2010) and could therefore add additional pressure and risk to a SME if not well managed. Bianchi et al. (2010) further suggested the use of methods such as TRIZ together with portfolio management tools and ranking techniques to identify "opportunities for out-licensing a firm's technologies outside its core business".

[5] See notes on changes to the OIL Framework in Appendix B from Improvement and Exploitation to Exploitation and Exploration

Design proposition 19 can then be defined as follows.

TABLE 7-24: DESIGN PROPOSITION 19

Context	Interaction	Mechanism	Outcome
Searching for additional value through exploitation and exploration (C19)	Requires the organisation to find opportunities (I19) within current and new customers, markets, channels, knowledge, and business models	Considering existing boundaries (M19.1) and new extended boundaries (M19.2)	Resulting in increased appropriated value (O19)

7.4.3 Open Innovation Measurement and Evaluation: Design Propositions

Establishing open innovation as a formal management practice within the organisation will require implementing a measuring system to evaluate the impact of open innovation on the performance of the organisation (Almquist et al., 2013). In the OIL Framework, measurement of open innovation covers two aspects. Firstly, establishing KPIs (what to measure) combined with performing the evaluations (measuring according to the established KPIs) and secondly, learning from those evaluations and other feedback sources. Design proposition 4 gives us the overall view for 'Measure and Evaluate' as defined previously.

TABLE 7-25: DESIGN PROPOSITION 4

Context	Interaction	Mechanism	Outcome
When in the 'measure and evaluate' OI phase of the OIL framework (C4)	Consider the following: • Innovation KPIs (I4.1) • Innovation reviews and learning (I4.2)	Through measurement (M4)	Performance measures to track how well the organisation is implementing and executing OI and where it needs to improve (O4), together with providing a structured way to increase the chances of success for open innovation in SMEs (O1)

7.4.3.1 Innovation KPIs

Golightly et al. (2012) found in their research that defining KPIs for open innovation is seen as a big challenge by organisations. There also seems to be limited research material for organisations to draw from and therefore KPIs are implemented based almost on a trial and error basis, finding 'best practice' KPIs which support their respective goals through learning and experience, rather than following a particular model. In another study from the European Union Development Fund (MED, 2012), their analysis concluded that "there is no single best measure of innovation". It is therefore more advisable to define measurement KPIs tailored to each organisation that will support the innovation objectives of the organisation, rather than hoping for a predefined model to implement. What is required is to assess the different measurement areas that can be used and then implement a measurement framework specific to the organisation and its innovation goals and open innovation methods adopted (Erkens et al., 2014).

Different types of innovation measures can be considered for adoption. Financial measurement is the method mostly used in organisations. These include indicators such as revenue growth, profit from new innovation, return on investment, profit per employee or income from patents and license fees (Chesbrough & Brunswicker, 2013; West & Bogers, 2014; MED, 2012).

Innovation measurements can also be categorised into input, process, output and outcome KPIs (Manceau, 2011; Chesbrough & Brunswicker, 2013; West & Bogers, 2014; Erkens et al., 2014). Manceau et al. (2011) mentioned some input, process and output KPIs as shown in Table 7-26 that organisations can consider for adoption. Two innovation measurement models that can be used as reference are the Innovation Management Measurement Framework by Adams et al. (2006), and the Innovation Assessment Balanced Scorecard by Nada (Nada, 2010) as proposed by the European Union Development Fund for good practice. In general, input, process and output measures can be described as:

- Input measures: The input elements into the innovation process, such as financial and human resources, training or organisational participation.
- Process measures: Measuring the activities during the innovation process, transforming inputs into outputs: number of OI projects, network size, time to market, etc.
- Output measures: The result of the innovation activities, such as number of new products, number of patents, number of completed projects.

Erkens et al. (2014) also added the additional measurement category of outcome to their open innovation measurement framework. They described outcome measures as the value of an innovation in terms of economic and market-oriented performance indicators such as revenue generated by OI.

As can be seen from the section above, finding the right measurement KPIs for open innovation is a daunting task with no single or simple answer. For SMEs, the author would recommend starting out with only a few measurements to help assess innovation impact. Once the organisation gets used to the discipline of innovation metrics, then more can be added or current ones can be adjusted to better suit their needs. It is about finding the correct balance between the effort of measuring and analysing KPIs, and the value that it serves in managing innovation performance.

TABLE 7-26: KPIS FOR OPEN INNOVATION

Input KPIs	Process KPIs	Output KPIs
Investment in OI (% of turnover)	Number of OI projects	Number of external ideas
Number of OI dedicated staff	Number of new partners	Number of projects achieved through OI
Specific recruitments to implement OI approach	Diversity of partners (type, locations, etc.)	Number of new products / services launched with partners
Number of involved departments in OI projects	Number of active partnerships	Time to market

Input KPIs	Process KPIs	Output KPIs
Number of registered innovators in the innovation network	Frequency of meetings with partners	Number of patents through OI projects (or other IP rights)
Quality of employees' involvement (number of ideas, contributions, etc.)	Time to respond to new ideas /solutions	Revenue generated through OI projects
% of staff's objectives on the achievement of OI planned results	Number of new products / services developed with partners	Number of OI success stories
Amount of OI rewards for employees	% of new ideas implemented from partners	Number of sustainability-related projects

TABLE 7-27: DESIGN PROPOSITION 20

Context	Interaction	Mechanism	Outcome
Innovation KPIs for open innovation (C20)	Must be organisation-specific, supporting chosen goals and methods (I20.1), and can include financial, input, process, output, and outcome KPIs as appropriate (I20.2)	Selected from measurement models and measurement categories (M20.1)	To measure and determine innovation performance (O20)

7.4.3.2 Innovation Reviews and Learning

Innovation performance must be reviewed to ascertain how successful the organisation's open innovation endeavours are faring. Assessments must provide a full overview of the open innovation framework steps performed thus far and include internal and external perspectives.

Enkel et el. (2011) recommended innovation measurement and monitoring activities, stating that self-assessment assisted with planning for continuous improvement, similar to Total Quality Management used in business and manufacturing management. "Knowing which elements to manipulate could thus help organisations to improve the quality and effectiveness of open innovation" (Enkel et el., 2011).

Analysing the set KPIs from the previous section, will be the first step in understanding open innovation performance. Having a dashboard view and comparing performance over time will give a good perspective on effectiveness and efficiency. Conducting an internal post-implementation and development review is also a strong project management technique to attain feedback and learn from employees on successes and failures (Enkel et el., 2011; Project Management Institute, 2008).

Obtaining feedback from your innovation partners is another good way to identify areas that are working and areas that may need further improvement. Feedback can either be via formal facilitated sessions or more informally, noting comments provided during the innovation process.

Benchmarking is another well-established management technique that can be employed to review innovation performance and how management practices compare with other companies.

Feedback and measurement only have purpose when insight is gained from them. Companies should use the information obtained to learn what works in their innovation process and what needs to change and improve. Knowledge develops through the articulation and coding of all the information sources (Garibaldo et al., 2007) that can feed into a continuous improvement cycle. “The learning that takes place is fed directly back into the extension of open thinking and innovative practice that allows firms to progress” (Golightly et al., 2012). This is an interactive and iterative process involving various role-players in the organisation as demonstrated in the model from Nonaka et al. (2001), in Schutte and Du Preez (2010).

From an SME perspective, when the organisation has only a few employees, these learning cycles can be rapid and can often be performed in a very informal manner. Proximity and size will be in the favour of the organisation, which often tends to be a barrier for larger organisations. Ideas can be freely shared and learning can then be achieved.

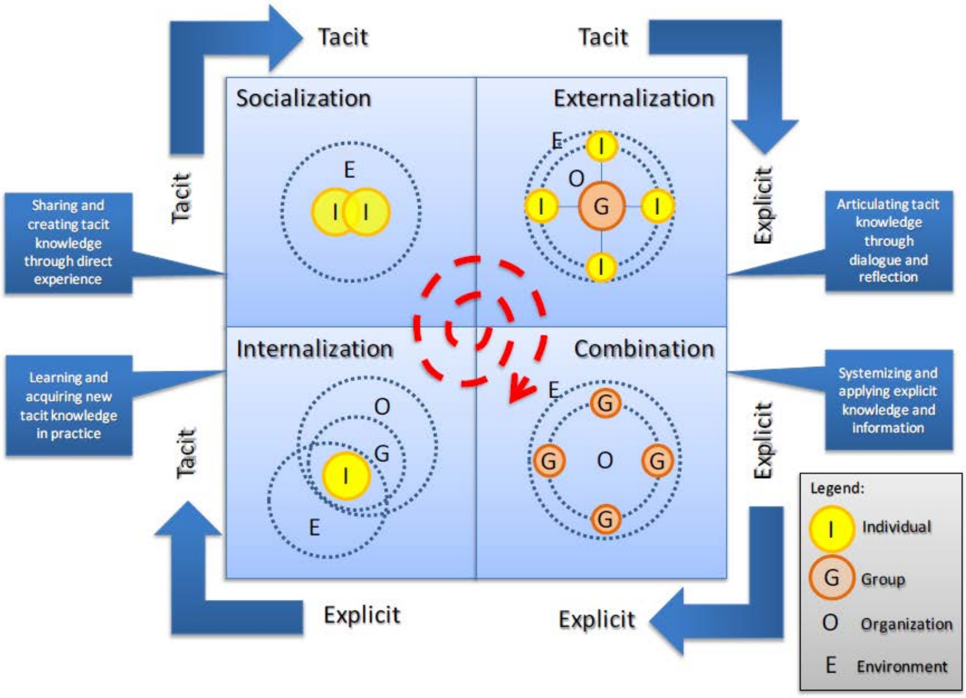


FIGURE 7-4: ORGANISATIONAL KNOWLEDGE CREATION SECI MODEL (SOURCE: SCHUTTE & DU PREEZ, 2010)

The following design proposition is proposed.

TABLE 7-28: DESIGN PROPOSITION 21

Context	Interaction	Mechanism	Outcome
Open innovation reviews and learning (C21)	Is facilitated through internal and external assessment and feedback on the innovation process and KPI performance (I21.1) which must then be translated	By applying informal and formal management methods such as benchmarking and lessons learnt sessions (M21.1) within a knowledge-creation cycle (M21.2)	Leading to new knowledge and insight on how to improve the organisation’s open innovation performance (O21)

	into tangible learnings and knowledge (I21.2)		

7.4.4 Improve and Mature Open Innovation: Design Propositions

Earlier in the chapter, definitions were provided for Maturity in terms of open innovation within the organisation as being either Limited, Transitional or Developed. Following the OIL Framework, we know that open innovation implementation and execution is not a once-off exercise, but follows a continuous cycle of improvement, in terms of efficiency, effectiveness and maturity. It takes time and investment to successfully implement and mature open innovation in an organisation (Golightly et al., 2012) as a long-term strategy.

To improve on the organisation's open innovation capabilities, one should take as input the measurement and learning outcomes to indicate areas where the organisation should focus its development efforts. The organisation will then go through a two-step process, developing improvement options, and then selecting from those options for implementation and adoption.

7.4.4.1 Open Innovation Improvement

The organisation should consider the following three subcomponents of the OIL Framework for improvement, namely Organisational Enablement, Open Innovation Process and Open Innovation Measurement.

Scrutinising the core elements within these sub-elements and drawing from improvement techniques, the SME can formulate improvements for implementation. It is important to note that the SME will not necessarily be able to implement all the proposed improvements due to various constraints such as available funding, partner network size and reach, and strategic intent. It is therefore important that a conscious business decision is made regarding which improvement ideas will be adopted in the organisation. Each core element can be assessed in terms of the design propositions put forward in the previous sections and the associated guidance notes and literature-based best practice.

Some improvement techniques that can also be considered are listed below (DTI, 2015):

- Process mapping and flowcharting
- Force field analysis
- Cause and effect diagrams
- Brainstorming
- Pareto analysis
- Statistical process control (SPC)
- Control charts
- Check sheets
- Bar charts
- Scatter diagrams
- Matrix analysis
- Dot plot or tally chart
- Histograms

The organisation should go through a decision process of which improvements will be adopted and how those changes will be rolled out into the organisation. Implementing too many changes at once may overload the organisation's absorptive capacity, thereby having a negative effect on its open innovation capability. The changes selected for adoption form a natural flow into the first subcomponent of Enable Open Innovation to bring the organisation into another cycle of Enablement and Execution, followed by Measurement and Improvement.

Selecting which changes will be adopted becomes a management decision based on various factors such as resource capacity, funds, original open innovation strategy, considered impact of changes, partner network considerations, and many others which will be unique to each SME.

The following design proposition is therefore proposed:

TABLE 7-29: DESIGN PROPOSITION 22

Context	Interaction	Mechanism	Outcome
For open innovation improvement (C22)	Review the outcomes from your review and learning exercise (I22.1) and develop improvement options (I22.2) for adoption (I22.3)	Drawing from the best practice notes and previous design propositions in each OIL framework sub-element (M22.1), additional improvement techniques (M22.2), and adoption selection criteria and management decisions	Improving the organisation's open innovation capability and maturity (O22) and leading into another OIL framework cycle (O23)

7.5 Chapter Conclusion

This chapter provided a synthesis of the literature, using the OIL Framework as boundaries to identify information, patterns, trends, and learnings to develop 22 design propositions for open innovation in SMEs. Using CIMO-logic, each design proposition was provided with elements of Context, proposed Interactions, associated Mechanisms and prospective Outcome, based on the literature discussion associated with the OIL Framework component.

The design propositions and associated detailed proposition descriptions provide the SME with a rich source of tools, references and commentary to consider when implementing, executing and improving open innovation within their organisations. The design propositions don't aim to be an exhaustive reference of all possible scenarios and literature on the subject, but to provide a comprehensive, yet palatable resource for SMEs to use.

The design propositions combine various resources and knowledge areas together in a single approach that can be accessible to SMEs. They provide guidance on the applicability of certain interactions based on the maturity level of the organisation, but similarly provide the SME with a view on what will be needed for / can be achieved at a higher maturity level.

By developing the design propositions, the fifth secondary research question and objective as defined in chapter 1 are addressed.

SRQ5: What design propositions can we develop for an open innovation approach for SMEs?

SRO5: To develop design propositions for an open innovation approach for SMEs

The 22 design propositions, together with and fitted within the OIL Framework therefore provide an approach for the SME to use for open innovation implementation, execution and improvement. The following chapter will develop this concept further and show how the approach becomes an accumulation of the artefacts developed during the design iterations.

Chapter 8: Open Innovation Approach

8.1 Integration

Chapters 5, 6 and 7 described the design iterations followed, aligned with the design science method which developed various design artefacts, related to the open innovation approach. This chapter will bring together the various outputs from these sections into a combined result – the open innovation approach.

8.1.1 The Research Objective

In chapter 1 the main research objective for this study was set as:

> Objective: To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.

The subsequent chapters and secondary research objectives provided steps towards achieving this objective, first by defining the requirements for such an approach and then developing a framework and design propositions. The following sections will summarise the output from these sections and show how their integration results in achieving the main research objective.

8.1.2 Framework and Design Propositions Summary

Following from the design requirements for an open innovation approach developed in chapter 5, the Open Innovation Lifecycle (OIL) Framework developed in chapter 6 provided a way to structure the approach and subsequent design propositions. It took into consideration the different elements needed within the approach as set out in the objective being implementation, execution and improvement.

The OIL Framework was based on a continuous improvement cycle that first considered the planning and preparation of the organisation for open innovation execution, then the execution of open innovation (doing the innovating), then ending off with measuring performance and improving the capability. The OIL Framework consists of the four main life cycle phases, with additional sub-elements within each phase. The framework in itself however only provided the high-level boundaries of the approach and still required detailed descriptions to be added to increase its utility.

Therefore, using the OIL Framework components and examining literature associated with each component topic as input into the design propositions, a literature synthesis was conducted, resulting in the development of 22 design propositions to be used for the implementation, execution and improvement of open innovation in SMEs.

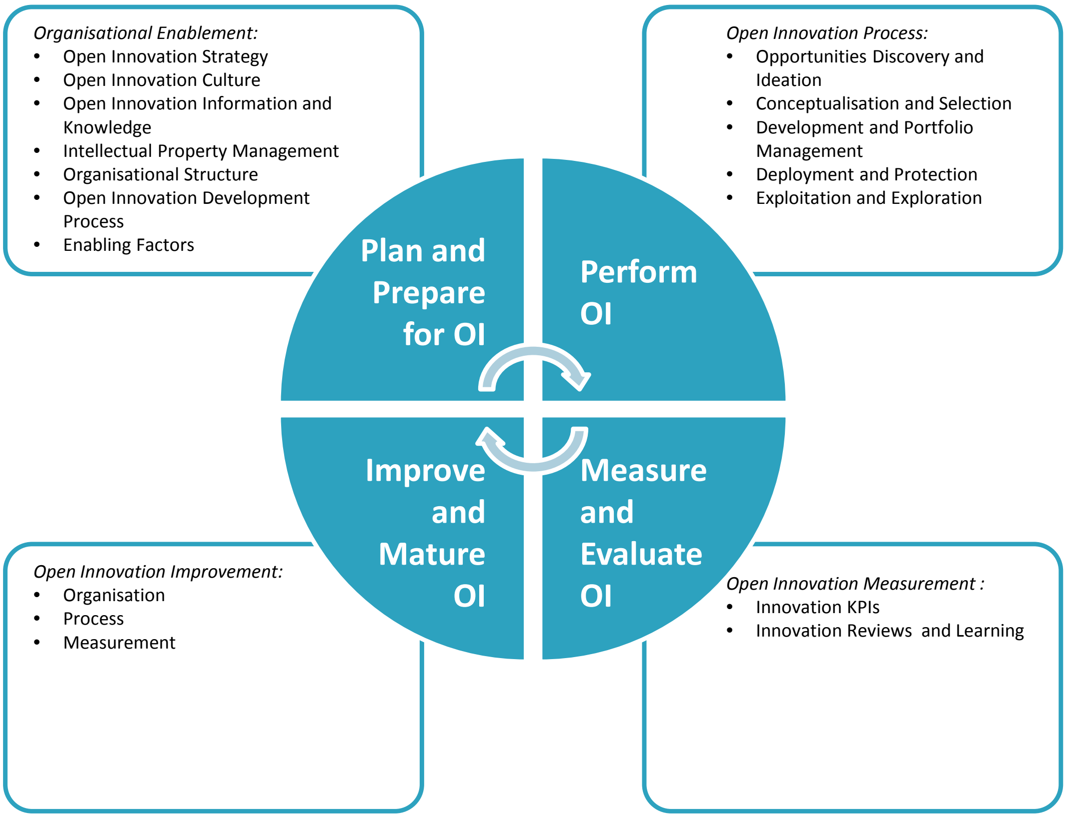


FIGURE 8-1: OIL FRAMEWORK V2

The 22 design propositions developed in chapter 7, to support the OIL Framework and provide further detail to the open innovation approach (supported by detailed descriptions), are listed below.

TABLE 8-1: OPEN INNOVATION DESIGN PROPOSITIONS

No.	Context	Interaction	Mechanism	Outcome
1	For SMEs to Implement, Execute and Improve open innovation in their organisations (C1)	Use the OIL Framework and Design Propositions (I1)	That contains appropriate routes and actions as a toolset within the open innovation approach (M1)	Providing a structured way to increase the chances of success for O open innovation pen Innovation in SMEs (O1)
2	When in the 'Plan and Prepare for OI' phase of the OIL Framework (C2)	Consider the following: • Open Innovation Strategy (I2.1) • Open Innovation Culture (I2.2) • Open Innovation	Aiding organisational enablement (M2) through strategic management decisions, policy decisions and organisational interventions	Thereby setting the organisation up for OI readiness (O2) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)

No.	Context	Interaction	Mechanism	Outcome
		Information and Knowledge (I2.3) • Intellectual Property Management (I2.4) • Organisational Structure (I2.5) • Open Innovation Development Process (I2.6) • Enabling Factors (I2.7)		
3	When in the 'Perform OI' phase of the OIL Framework (C3)	Consider the following: • Opportunities Discovery and Ideation (I3.1) • Conceptualisation and Selection (I3.2) • Development and Portfolio (I3.3) • Management (I3.4) • Deployment and Protection (I3.5) • Improvement and Exploitation (I3.6)	Embedded in a structured open innovation process (M3) to develop new product and service innovations	Delivering OI in the organisation (O3) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)
4	When in the 'Measure and Evaluate OI' phase of the OIL Framework (C4)	Consider the following: • Innovation KPIs (I4.1) • Innovation Reviews and Learning (I4.2)	Through the measurement (M4) and evaluation of formal performance indicators to obtain insights and learnings	Performance measures to track how well the organisation is implementing and executing OI and where it needs to improve (O4), together with providing a structured way to increase the chances of success for open

No.	Context	Interaction	Mechanism	Outcome
				innovation in SMEs (O1)
5	When in the 'Improve and Mature OI' phase of the OIL Framework (C5)	Consider the following: • Organisation (I5.1) • Process (I5.2) • Measurement (I5.3)	Requiring the selection of continuous improvement options and adoption of changes into the organisation (M5)	Resulting in increased OI maturity in the organisation (O5) and providing a structured way to increase the chances of success for open innovation in SMEs (O1)
6	When developing an open innovation strategy (C6)	Decide on innovation goals aligned to business strategy (I6.1; L,T,D) and obtain an innovation portfolio view (I6.2; T,D)	Managing and balancing investment and risk (M6)	Providing a view of the innovation which will be developed (O6)
7	When selecting an open innovation approach (C7)	Decide between an inbound (I7.1; L,T,D), outbound (I7.2; L,T,D), or coupled process (I7.3; T,D)	Drawing from your Absorptive (M7.1), Multiplicative (M7.2) and Relational (M7.3) Capacities	Showing where the organisation will open up its innovation process (O7)
8	For open innovation method and partner selection (C8)	Decide on the open innovation method(s) (I8.1) aligned with the chosen open innovation approach (I7). Select the appropriate partner orientation: • Immediacy (I8.2; L,T) • Topic (I8.3; T, D) • Partner (I8.4; T,D) • Open (I8.5; D) and partners (I8.6)	Considering innovation depth (M8.1), breadth (M8.2) and intensity (M8.3)	Establishing a partner and network management landscape (O8)

No.	Context	Interaction	Mechanism	Outcome
9	When changing the innovation culture to be more open (C9)	Drive change through clear top management commitment, communication and involvement (I9.1)	Moving from a 'not-invented-here' to a 'proudly-found-elsewhere' paradigm (M9.1)	Creating a safe and open, innovation culture (O9)
10	When managing knowledge during innovation (C10)	Establish formal practices to manage complex and distributed knowledge internal and external to the organisation (I10.1), leveraging technology to simplify this task and to connect to other complimentary organisational platforms (I10.2; T,D)	Through the configuration of knowledge capacities (M10.1) and collaborative technology platforms (M10.2)	For effective knowledge utilisation (O10)
11	Intellectual Property Management requires (C11)	Setting up an IP framework for the organisation to clarify its intended use of protection mechanisms (I11.1) and establishing appropriate agreements with collaboration partners (I11.2; T,D)	Assisted by sound advice from IP experts on the different IP mechanisms available (M11.1) such as patents, trademarks, trade secrets and copyright	Ensuring clearly assigned and protected IP (O11)
12	The impact on Organisational Structures and Networks will require (C12)	Assigning new roles (I12.1; L,T,D) and possible new structures (12.2; T,D) supportive of open innovation and establishing and nurturing internal and external innovation networks (I12.3; L,T,D)	Providing responsibilities and mandates to execute open innovation (M12.1) and manage partner/innovator relationships	Resulting in an open organisational structure and innovation network (O12)

No.	Context	Interaction	Mechanism	Outcome
13	The Process of Open Innovation Development (C13)	Requires the training of new open innovation skills to employees (I13.1; L,T,D)	Being introspective, extrospective, interactive and technical (M13.1)	Creating a blend of available skills for an organisational open innovation mindset (O13)
14	Open Innovation Enablement requires Enabling Factors (C14)	Such as the implementation of clear policies (I14.1), managing change (I14.2) and a final readiness assessment (I14.3)	Strengthening governance (M14.1) and leveraging industry change frameworks (M14.2) and readiness checklists (M14.3)	For an enabling environment to execute open innovation (O14)
15	When performing Opportunity Discovery and Ideation (C15)	Define the needs that will be addressed by the ideas to be sourced (I15.1; L,T,D), select the ideation partners to work with and methods to obtain ideas (I15.2;L,T,D), and run idea campaigns (I15.3;L,T,D)	Using appropriate platforms to capture ideas (M15.1) and incentives to increase participation (M15.2)	Resulting in a pipeline of new innovation ideas and opportunities (O15)
16	Conceptualisation and Selection (C16)	Requires the organisation to further develop the ideas into concepts (I16.1; L,T,D) and filter them for further investment and development (I16.2;L,T,D) or value capturing outside of the organisation (I16.3;T,D)	According to a set filtering criteria (M16.1)	For a list of innovation projects to develop (O16)
17	During Development and Portfolio Management (C17)	Balance the innovation portfolio according to selected criteria (I17.1; L,T,D) and manage internal (I17.2;L,T,D) and	Using project management standards such as PMBOK and Agile (M17.1)	To develop products or services that can be commercialised (O17)

No.	Context	Interaction	Mechanism	Outcome
		external resources (I17.3;T,D)		
18	To Deploy a new innovation into the market (C18)	The organisation will take sole or joint ownership depending on the innovation strategy adopted (I18.1; L,T,D) and the innovation protected (I18.2;L,T,D)	Through the adoption of deployment practices (M18.1) and IP frameworks (M18.2)	To achieve successful deployment (O18)
19	Searching for additional value through Exploitation and Exploration (C19)	Requires the organisation to find opportunities (I19) within current and new customers, markets, channels, knowledge and business models	Considering existing boundaries (M19.1) and new extended boundaries (M19.2)	Resulting in increased appropriated value (O19)
20	Innovation KPIs for open innovation (C20)	Must be organisation-specific, supporting chosen goals and methods (I20.1) and can include financial, input, process, output and outcome KPIs as appropriate (I20.2)	Selected from measurement models and measurement categories (M20.1)	To measure and determine innovation performance (O20)
21	Open Innovation Reviews and Learning (C21)	Are facilitated through internal and external assessment and feedback on the innovation process and KPI performance (I21.1) which must then be translated into tangible learnings and knowledge (I21.2)	By applying informal and formal management methods such as benchmarking and lessons learnt sessions (M21.1) within a knowledge-creation cycle (M21.2)	Leading to new knowledge and insight on how to improve the organisation's open innovation performance (O21)
22	For Open Innovation Improvement (C22)	Review the outcomes from your Review and Learning	Drawing from the best practice notes and previous design	Improving the organisation's open innovation capability

No.	Context	Interaction	Mechanism	Outcome
		exercise (I22.1) and develop improvement options (I22.2) for adoption (I22.3)	propositions in each OIL Framework sub-element (M22.1), additional improvement techniques (M22.2) and adoption selection criteria and management decisions	and maturity (O22) and Leading into another OIL Framework cycle (O23)

8.2 Discussion

The design propositions represent an open innovation approach for SMEs to follow, regardless of their open innovation maturity level. The approach is flexible enough to cater for various contexts that the SME might face, without limiting its application. A balance is sought between prescription and own judgement.

The design propositions are captured in an open innovation life cycle framework that aims to improve the process of innovation continuously within the organisation, and to make it a more predictable and repeatable process. Each design proposition guides the user through suggestions to consider throughout the open innovation life cycle, with options obtained from the literature on innovation and business management methods, thus formalising efforts that are often ad hoc in nature in many SMEs.

The first five design propositions (1 to 5), provide boundaries within which to apply the subsequent design propositions, in line with the open innovation life cycle framework. Design propositions 6 to 14 focus on setting up the organisation for open innovation. They address issues such as strategy alignment, organisational structure, culture, intellectual property management, and open innovation method selection. They prepare the organisation to begin the innovation process.

Design propositions 15 to 19 describe the steps within the innovation process. They take the user through these five steps, starting with new idea discovery for an innovation, and ending with ways to extract the most value from the innovation after launching it in the market. Not all of the steps would necessarily be followed, such as when an idea is developed only to the concept phase, but is then sold to an outside organisation in the form of a patent to take to market.

The next two design propositions (20 and 21) guide the organisation in measuring and evaluating its open innovation performance. Appropriate KPIs can be selected and measured, providing input into a process of evaluation and learning.

This then leads to the last design proposition, which creates options for improvement and a selection process to carry options into the next cycle of open innovation application.

As an example of how to use a design proposition, design proposition six will be used as an example, and a possible scenario will be described.

TABLE 8-2: DESIGN PROPOSITION 6

Context	Interaction	Mechanism	Outcome
When developing an open innovation strategy (C6)	Decide on innovation goals aligned to business strategy (I6.1; L,T,D) and obtain an innovation portfolio view (I6.2; T,D)	Managing and balancing investment and risk (M6)	Providing a view of the innovation which will be developed (O6)

Using this design proposition, which sits in the first phase of the OIL Framework, the SME would look at how to set up the organisation for open innovation and, following the design proposition, develop an open innovation strategy. The first part of the *Interaction* — deciding on innovation goals — is suggested for organisations at all levels of maturity, whereas developing an innovation portfolio view is only recommended for organisations at a transitional or developed level of maturity. This does not mean that organisations at a limited level of maturity cannot also consider this step; but it would normally be more difficult for them, due to factors such as the size of the organisation, the structures and processes in place, and the number of innovation projects they can manage at any given time. The theoretical review used to derive the propositions provides insight into how to perform these tasks in more detail. SMEs would further consider their own risk appetite and the finances available to them to invest in innovation, resulting in a view of which innovation will be developed in the organisation aligned to their business strategy.

Working through the design propositions therefore gives SMEs a structured approach when applying open innovation in their organisations. It is not necessarily a strictly linear process; the user can apply discretion and judgment either to skip certain propositions if they are not applicable to their situation, or to iterate through them multiple times if required.

8.3 Open Innovation Templates

To make the design propositions more accessible and user-friendly, the author developed templates that can be used by the SME during the process of applying the design propositions in their organisation. Simplifying theory into a template (or canvas) has gained a lot of support in the last few years, taking academic concepts and turning them into practical tools for use. Examples of this trend can be seen in the work of Osterwalder (2009) and the popular Business Model Canvas or the canvases available from the open innovation agency '100%Open'.

Following a similar approach, the author developed templates for the design propositions for the SME to use as part of their open innovation toolkit. The templates supplement the design propositions and aim to make it easier for SMEs to apply them in their organisations.

Eighteen templates were developed to cover the key questions that the SME should ask during the use of the open innovation approach. They allow for an easier way to engage with the content and to facilitate discussion between team members in the organisation. Each template shows which quadrant in the OIL framework the user is in, provides the applicable design proposition in CIMO-logic format, and then poses questions to be completed by the SME that will address the specific section of the approach. This can, for example, be to define the open innovation method chosen, or to choose the preferred partners with whom to engage. The detailed descriptions from the design propositions are used in conjunction with the templates to serve as additional reference material on options to explore, tools to consider, etc. to better answer the questions posed in the templates. Depending on the iteration the user is moving through, the approach and the level of content knowledge will determine the level of use of the reference material. An advanced user may be comfortable using only the templates without the detailed descriptions, whereas a new user may rely more heavily on the supporting material.

The first template serves as an introduction to the use of the templates and also determines the organisation's open innovation maturity level. This is needed to help navigate the design propositions where the maturity levels are applicable. The first 5 design propositions (Table 8-1) provided the boundaries for the design propositions within which the design propositions are applied (aligned to the OIL Framework). These are therefore not covered by the templates, since the remaining design propositions will cover the application of the design propositions within the OIL Framework boundaries. The templates therefore cover design propositions 6 to 22. Each template aligns to a design proposition and incorporates the key questions derived from the design proposition and detailed descriptions that the SME needs to consider.

The development of the templates formed the third and last design cycle within the design sciences method followed in this dissertation. As with the previous cycles, it built on previous knowledge and artefacts produced through this research.

8.3.1 Open Innovation Template Design

The template layout is simple in design and shows the applicable OIL Framework component in the top left-hand corner, together with the associated visual orientation of where the component fits into framework. The SME can therefore navigate and keep track of where in the open innovation life cycle they are. The design proposition is then given in full to provide the CIMO-logic descriptions in tabular format. Based on the design proposition, key questions are summarised in the template for the SME to answer. The questions relate to the interactions and mechanisms of the design proposition and the SME will have the option to either adopt or ignore these.

The SME has the option to refer to the detailed descriptions relating to the design proposition for more information on the questions and specific tools and techniques that can be utilised. The templates can be used by individuals or by groups when workshopping ideas and strategies to adopt in the open innovation journey. These templates can then be referenced (and updated) during the open innovation life cycle.

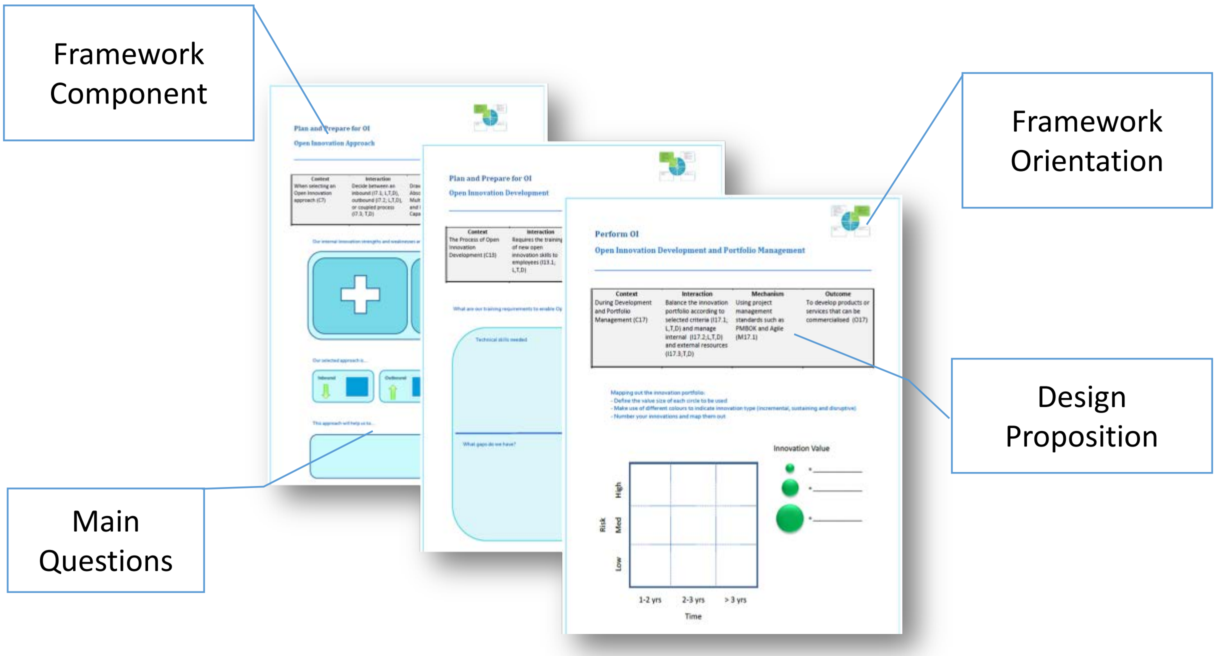


FIGURE 8-2: TEMPLATE DESIGN

The development of the templates followed a creative design step, with no predefined structure – such as CIMO-logic used during the design propositions – that helped to define the templates. The templates became an aggregation and simplification of the knowledge and artefacts developed thus far in the approach. The templates created a visual and more simplified interface for users to work with the approach. Because of their creative design, the templates' usefulness and merit were determined through validation by the user. This is tested in the next chapter.

8.3.2 Templates

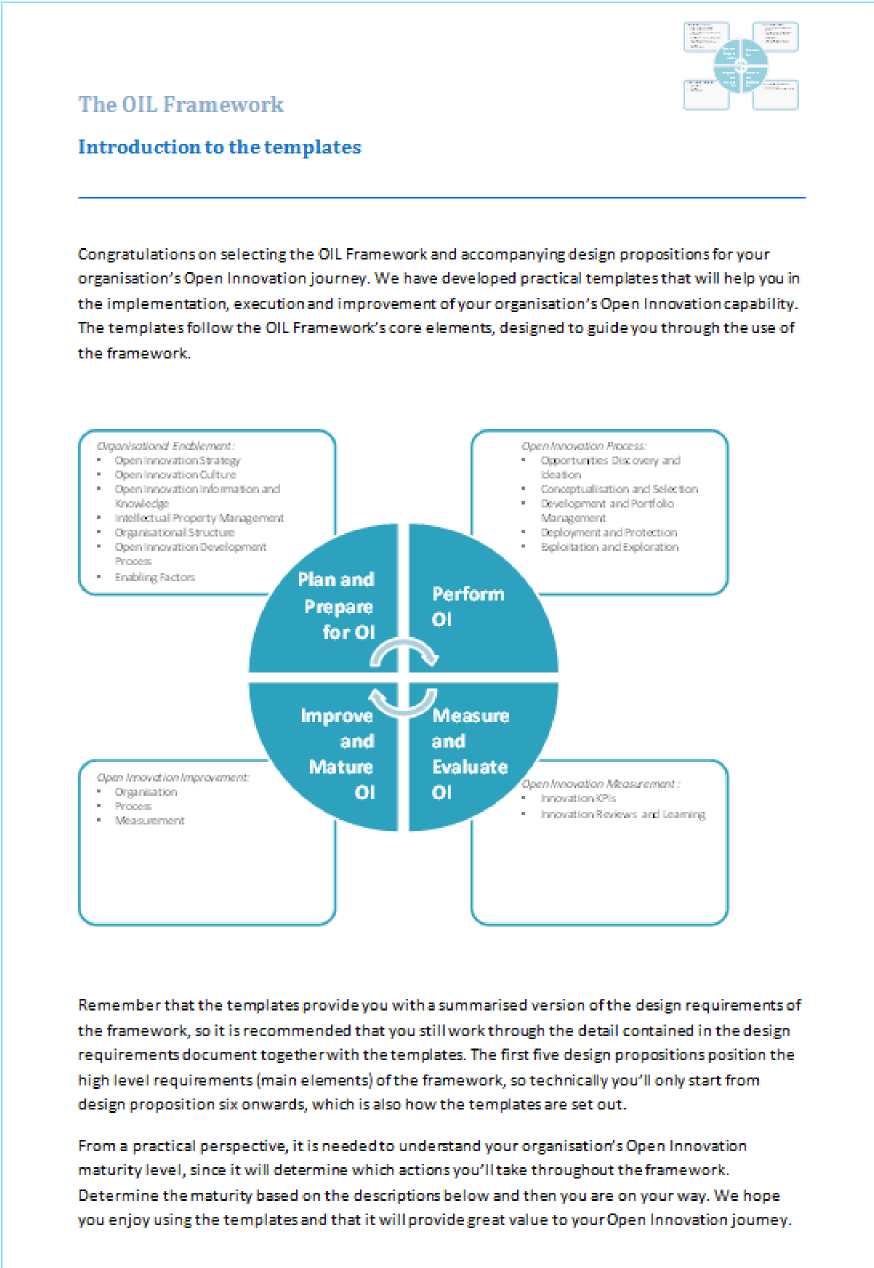
The following 18 templates form the collection of templates the SME can use in implementing the open innovation approach. It is not required to complete all the templates or all the questions within each template, although it would add most value if all the templates and questions were at least considered, before deciding on their completion.

The time that it will take the SME to complete the templates will vary depending on the pace of adoption and implementation in the organisation. In particular, the templates relating to the execution phase may take a substantial amount of time to complete, due to the nature of the development and commercialisation process. If more than one product is being developed, then there may also be multiple templates being completed of the same OIL framework component, but for different products.

The templates will be briefly discussed in the next section.

8.3.2.1 Introduction and Maturity

The first template introduces the SME to the open innovation templates and how they should be used in conjunction with the detailed design proposition descriptions. It also assesses the innovation maturity of the organisation. It provides a baseline for the SME to assess their maturity level as they commence the innovation process and to understand which proposition interactions will be relevant to them.



The OIL Framework

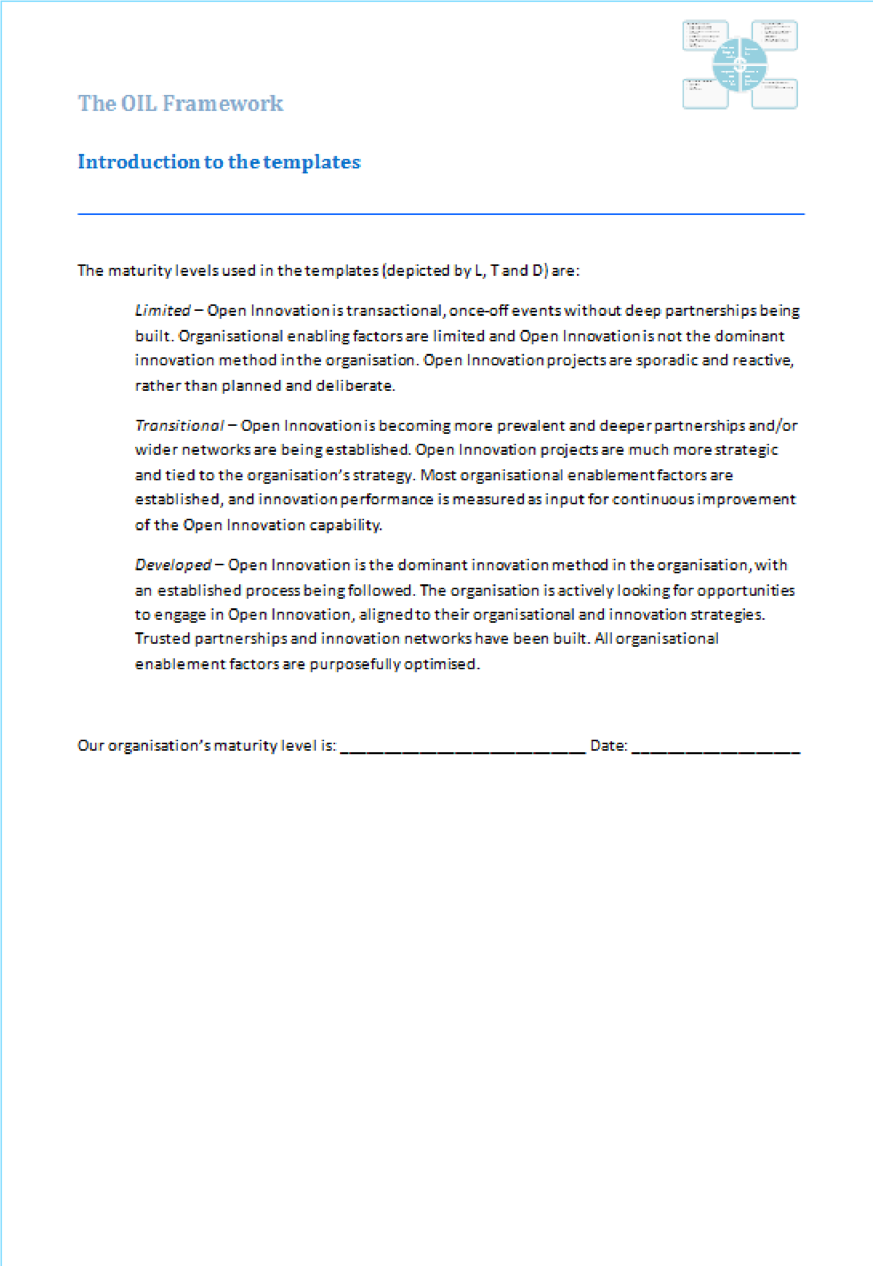
Introduction to the templates

Congratulations on selecting the OIL Framework and accompanying design propositions for your organisation's Open Innovation journey. We have developed practical templates that will help you in the implementation, execution and improvement of your organisation's Open Innovation capability. The templates follow the OIL Framework's core elements, designed to guide you through the use of the framework.

Remember that the templates provide you with a summarised version of the design requirements of the framework, so it is recommended that you still work through the detail contained in the design requirements document together with the templates. The first five design propositions position the high level requirements (main elements) of the framework, so technically you'll only start from design proposition six onwards, which is also how the templates are set out.

From a practical perspective, it is needed to understand your organisation's Open Innovation maturity level, since it will determine which actions you'll take throughout the framework. Determine the maturity based on the descriptions below and then you are on your way. We hope you enjoy using the templates and that it will provide great value to your Open Innovation journey.

FIGURE 8-3: INTRODUCTION TO THE TEMPLATES (PAGE 1)



The OIL Framework

Introduction to the templates

The maturity levels used in the templates (depicted by L, T and D) are:

Limited – Open Innovation is transactional, once-off events without deep partnerships being built. Organisational enabling factors are limited and Open Innovation is not the dominant innovation method in the organisation. Open Innovation projects are sporadic and reactive, rather than planned and deliberate.

Transitional – Open Innovation is becoming more prevalent and deeper partnerships and/or wider networks are being established. Open Innovation projects are much more strategic and tied to the organisation's strategy. Most organisational enablement factors are established, and innovation performance is measured as input for continuous improvement of the Open Innovation capability.

Developed – Open Innovation is the dominant innovation method in the organisation, with an established process being followed. The organisation is actively looking for opportunities to engage in Open Innovation, aligned to their organisational and innovation strategies. Trusted partnerships and innovation networks have been built. All organisational enablement factors are purposefully optimised.

Our organisation's maturity level is: ________________________ Date: ________________

FIGURE 8-4: INTRODUCTION TO THE TEMPLATES (PAGE 2)

8.3.2.2 Plan and Prepare for Open Innovation

The following nine templates cover the 'Plan and Prepare for Open Innovation' section of the OIL Framework. The templates focus on setting up the organisation to innovate in an open way and consider elements such as strategy, organisational structure, culture and IP.

The first template covers the key questions relating to the innovation strategy and linking it to the business strategy for alignment. It helps the SME to be clear on their innovation goals, and for more mature SMEs, how they would like their innovation portfolio to be balanced.

Being more clear on how much risk they are willing to take in innovation and the amount of investment they can put towards their innovation initiatives will help inform decisions later on regarding innovation methods, partners, support structure and size of innovation projects that can be undertaken.

The strategy template can constantly be referred back to, to make sure that the innovation decisions and actions align to the defined strategies and goals and also updated if the organisation's business strategy changes.

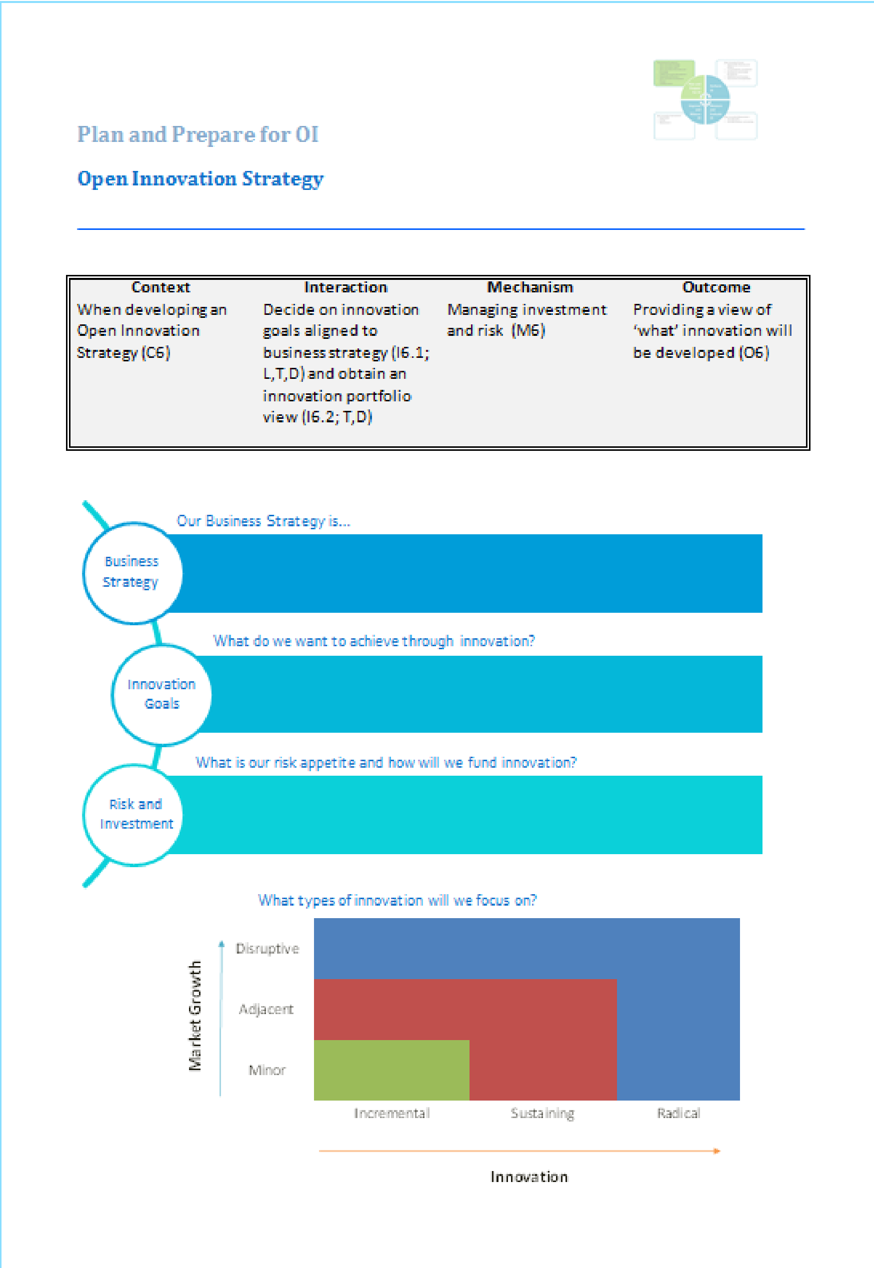


FIGURE 8-5: OPEN INNOVATION STRATEGY

Organisations would normally open up for innovation in areas where they need additional help or have very specific weaknesses to overcome. Areas where organisations have competitive advantages would normally remain closed. The next template makes it clear to the SME where they need to open up for innovation, thereby assisting them to select the appropriate innovation approach. The SME would have to consult the detailed notes for more insight on the mechanisms mentioned and how that will impact their selection.

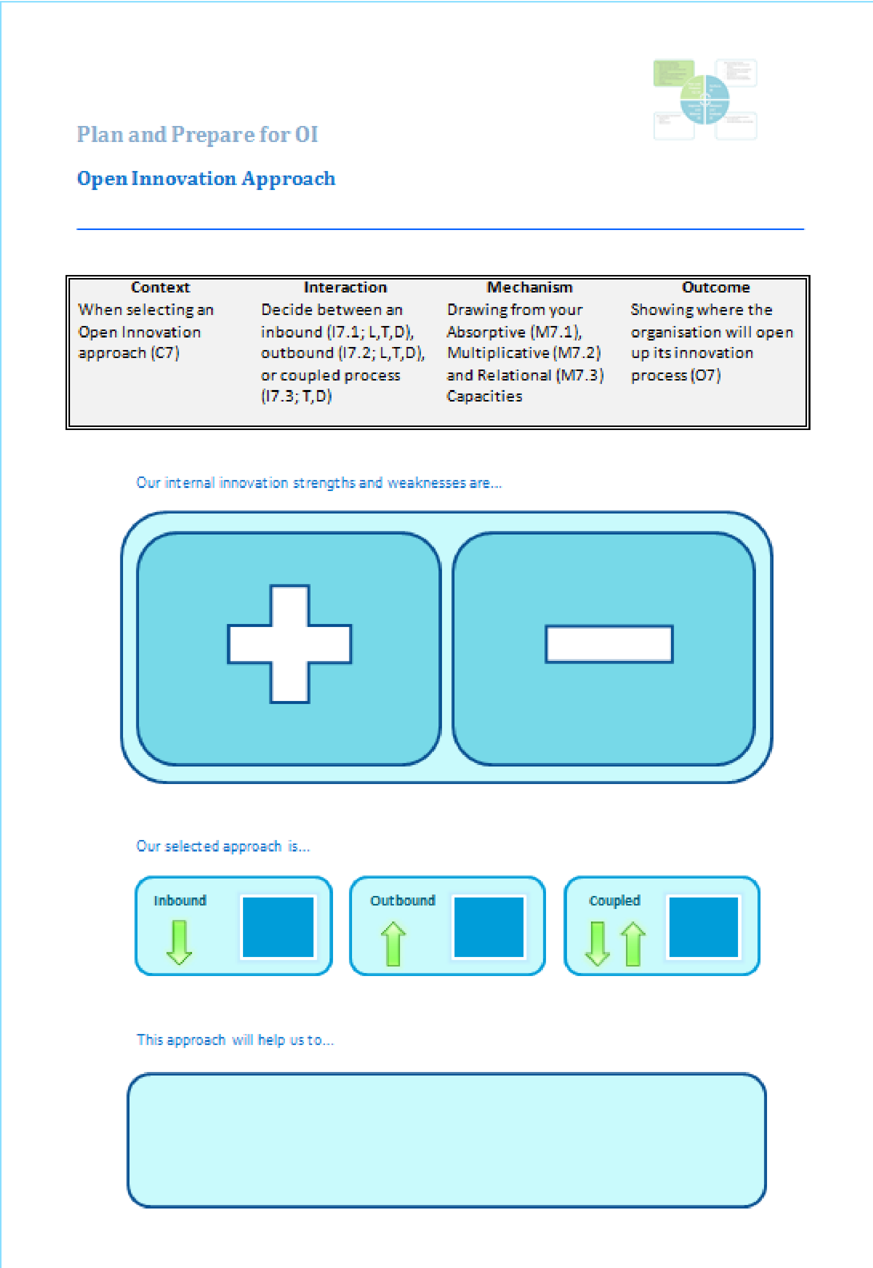


FIGURE 8-6: OPEN INNOVATION APPROACH

The following template will help the SME make decisions on the open innovation method(s) to support the approach selected before. The partner orientation helps to decide on the best innovation partners to support the orientation. The mechanism considerations from the detailed notes will help in forming the Interaction decisions, such as how many partners to approach, although this might rather be a result of the interaction. Selecting the partners will show the SME's innovation network that will have to be nurtured and maintained, also indicating complexity and breadth.

Plan and Prepare for OI

Open Innovation Method and Partner

Context	Interaction	Mechanism	Outcome
Open Innovation method and partner selection (C8)	Decide on the open innovation method(s) (I8.1) aligned with the chosen open innovation approach (I7). Select the appropriate partner orientation • Immediacy (I8.2; L,T) • Topic (I8.3; T, D) • Partner (I8.4; T,D) • Open (I8.5; D) and partners (I8.6)	Considering innovation depth (M8.1), breadth (M8.2) and intensity (M8.3)	Partner and network management landscape (O8)

Our selected method(s) for Open Innovation

- [ ] IP in-licensing or acquisition
- [ ] Informal or formal networking
- [ ] Contracted R&D
- [ ] Joint ventures or alliances
- [ ] Idea and start-up competitions
- [ ] Customer immersion
- [ ] Supplier innovation
- [ ] Spin-offs
- [ ] Crowdsourcing
- [ ] IP out-licensing or selling
- [ ] Customer co-creation
- [ ] Corporate business incubation
- [ ] Other:
- [ ] Other:

FIGURE 8-7: OPEN INNOVATION METHOD AND PARTNER (PAGE 1)

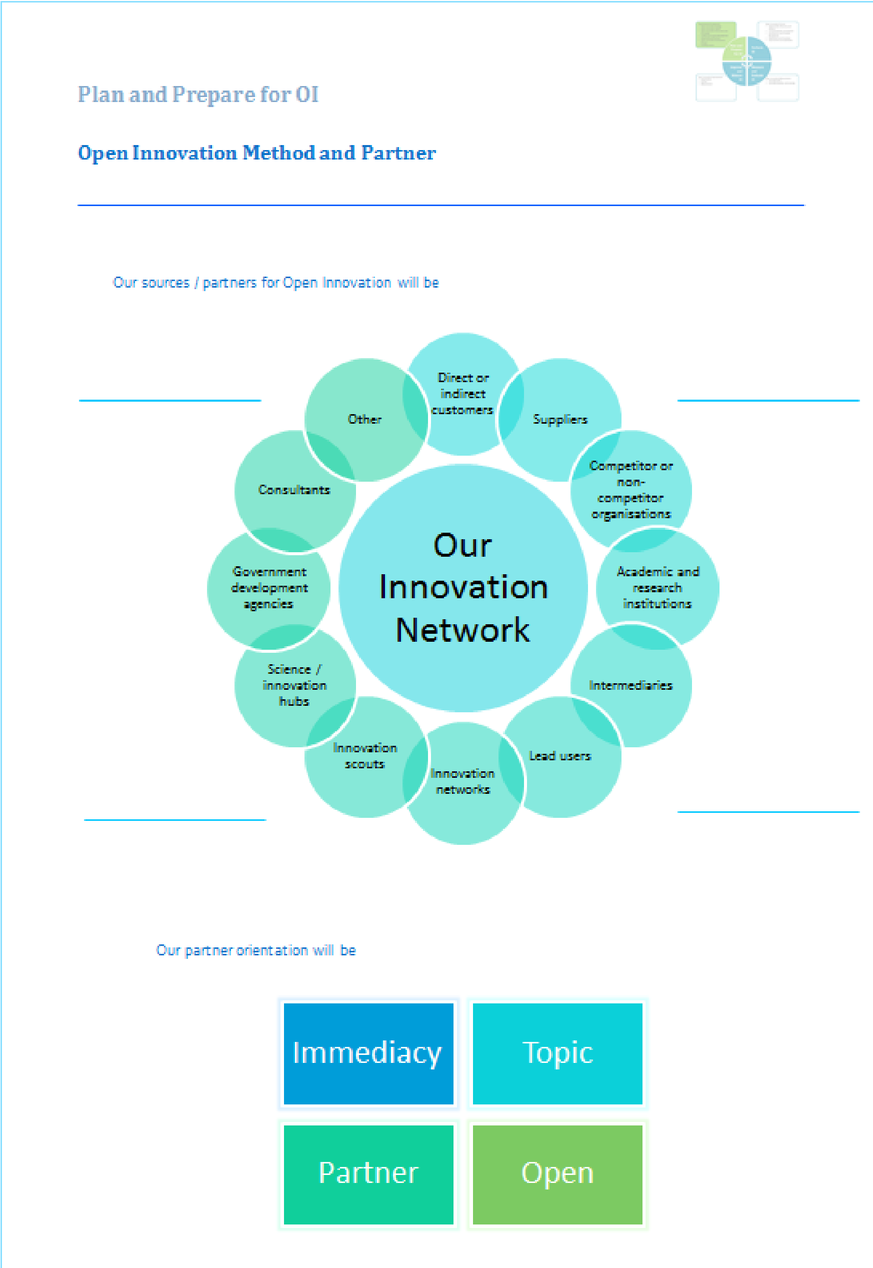


FIGURE 8-8: OPEN INNOVATION METHOD AND PARTNER (PAGE 2)

The template on culture is strongly driven by leadership commitment. Because owners and leaders in SMEs often play such a direct role in the organisation's daily activities, this is very pertinent. The SME leadership will define how they will show their support for the open innovation adoption in the organisation and how they will get involved to lead by example. Clear communication strategies are defined as well as the intended change in the organisation's openness in innovation through a supportive culture.

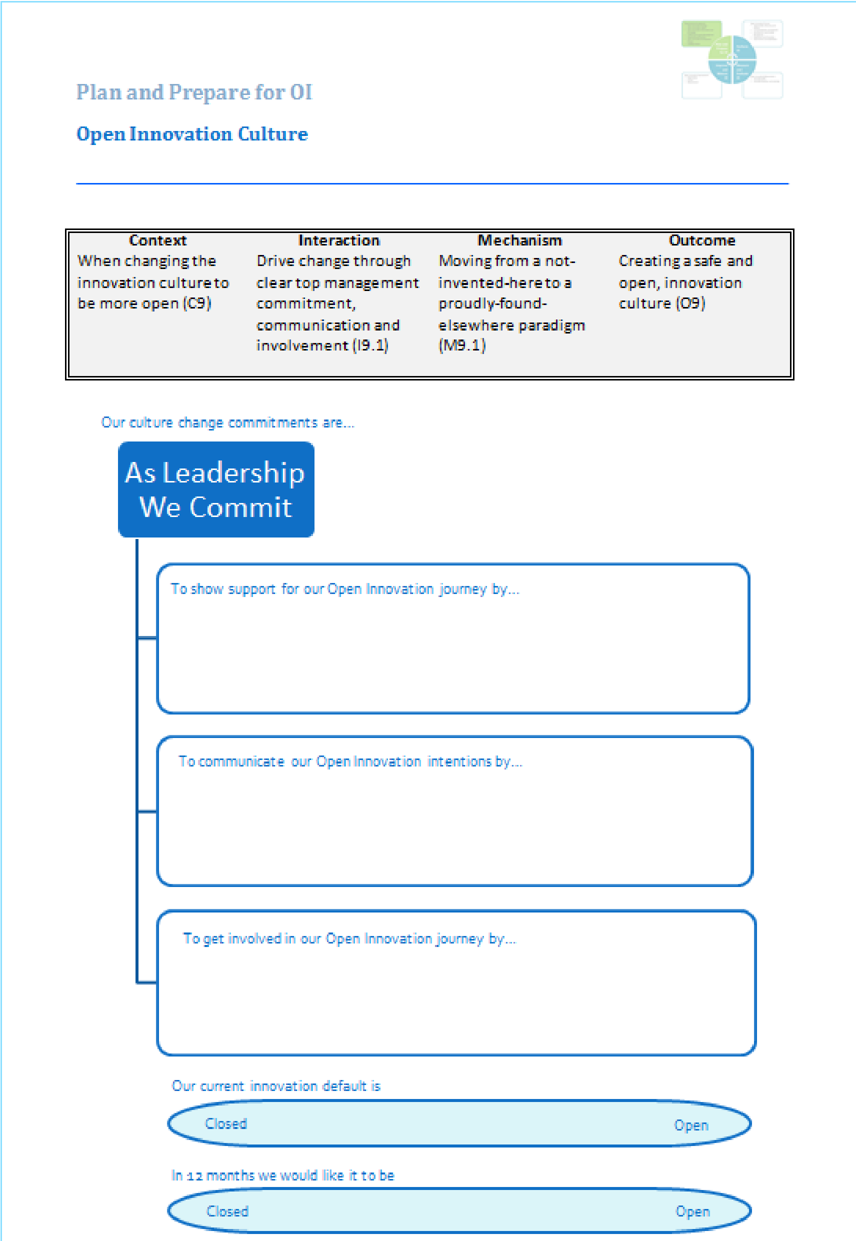
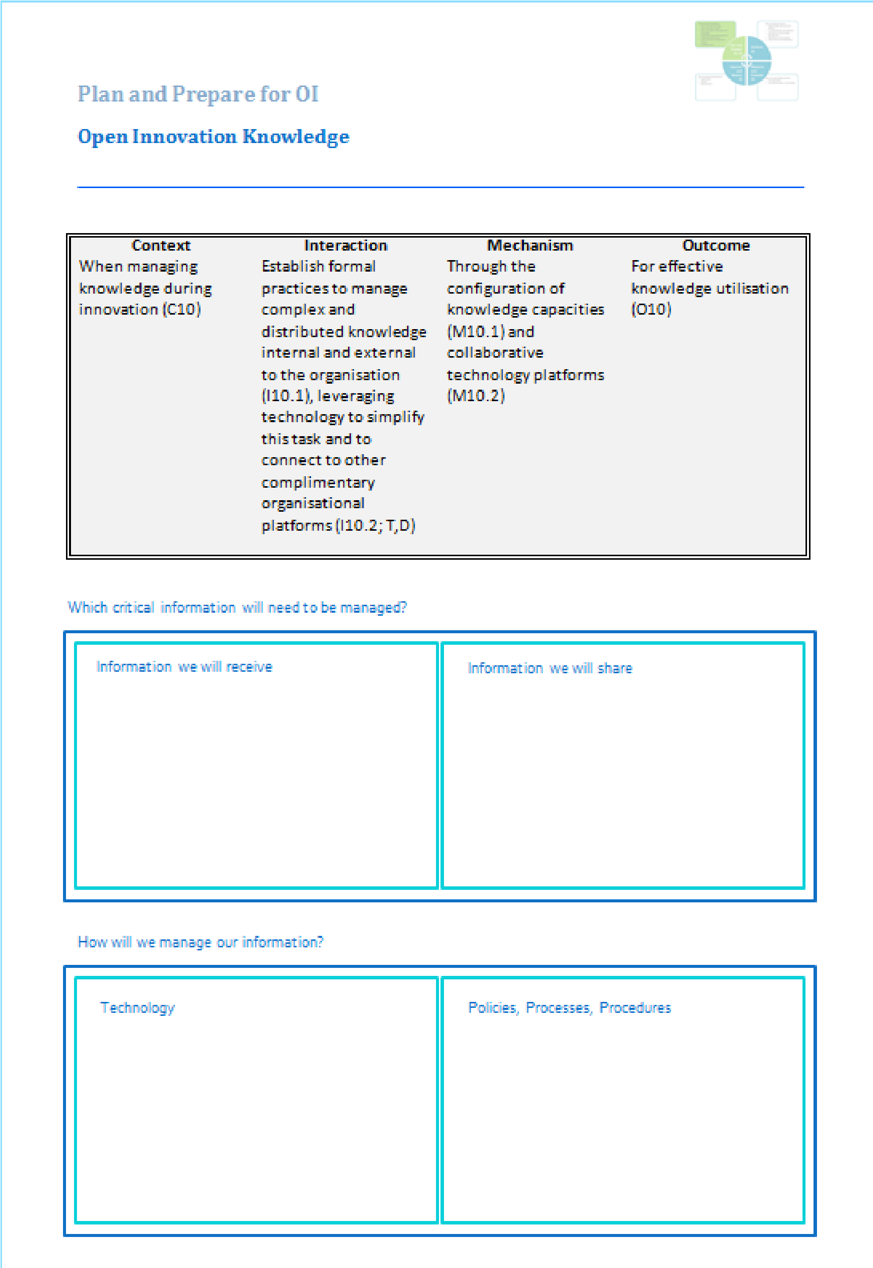


FIGURE 8-9: OPEN INNOVATION CULTURE

Even though knowledge management may not be a common practice in many SMEs, this template aims to start formalising the type of information that will have to be managed both flowing into and out of the organisation. Mature organisations can also look at more advanced technology solutions to help with the management of information and knowledge throughout the open innovation process.


Plan and Prepare for OI

Open Innovation Knowledge

Context	Interaction	Mechanism	Outcome
When managing knowledge during innovation (C10)	Establish formal practices to manage complex and distributed knowledge internal and external to the organisation (I10.1), leveraging technology to simplify this task and to connect to other complimentary organisational platforms (I10.2; T,D)	Through the configuration of knowledge capacities (M10.1) and collaborative technology platforms (M10.2)	For effective knowledge utilisation (O10)

Which critical information will need to be managed?

Information we will receive

Information we will share

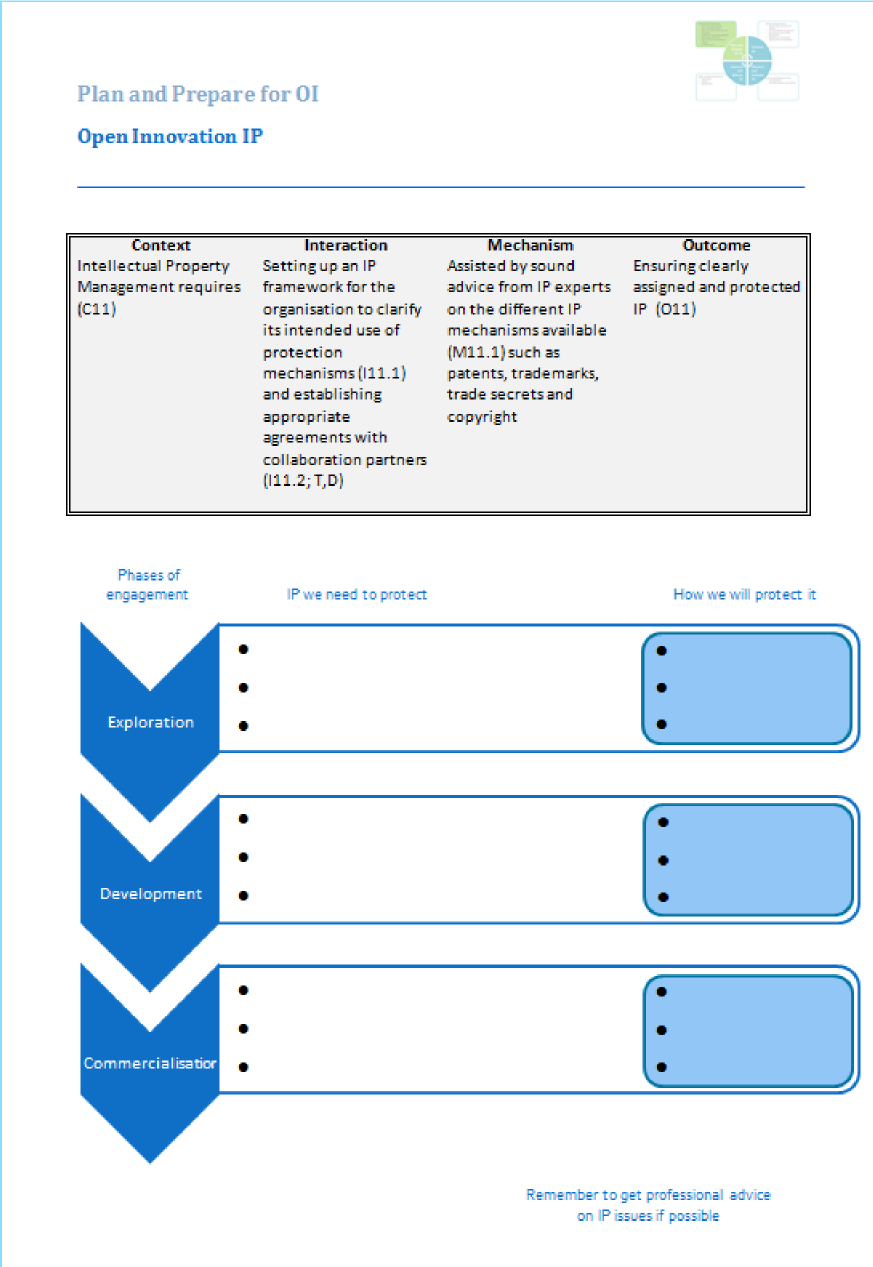
How will we manage our information?

Technology

Policies, Processes, Procedures

FIGURE 8-10: OPEN INNOVATION KNOWLEDGE

The in- and outflow of information and knowledge requires a protective IP framework to guard against the loss of value. IP management is a very specialised field, so the SME is advised to consider obtaining assistance with IP protection decisions. The template, however, starts to develop the high-level landscape of IP that needs to be protected and the potential mechanisms for doing so.



Context	Interaction	Mechanism	Outcome
Intellectual Property Management requires (C11)	Setting up an IP framework for the organisation to clarify its intended use of protection mechanisms (I11.1) and establishing appropriate agreements with collaboration partners (I11.2; T,D)	Assisted by sound advice from IP experts on the different IP mechanisms available (M11.1) such as patents, trademarks, trade secrets and copyright	Ensuring clearly assigned and protected IP (O11)

FIGURE 8-11: OPEN INNOVATION IP

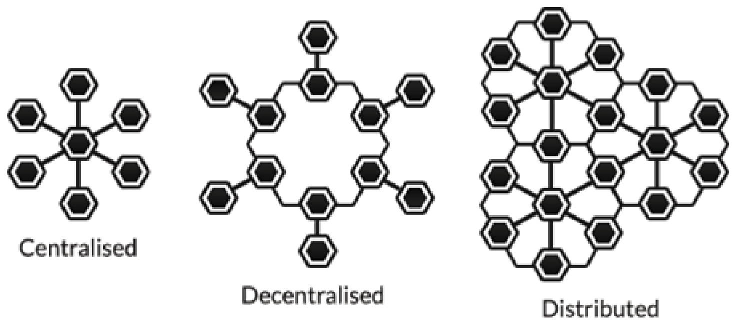
Managing open innovation within the organisation adds additional pressure on internal roles to manage the new processes and interactions with innovation partners. This may require new roles and responsibilities to be assigned or created. These new networks will also require active management that needs to be allocated to employees within the organisation.

Plan and Prepare for OI

Open Innovation Org Structure and Networks

Context	Interaction	Mechanism	Outcome
The impact on Organisational Structures and Networks will require (C12)	Assigning new roles (I12.1; L,T,D) and possible new structures (12.2; T,D) supportive of open innovation and establishing and nurturing internal and external innovation networks (I12.3; L,T,D)	Providing responsibilities and mandates to execute open innovation (M12.1) and manage partner/innovator relationships	Resulting in an open organisational structure and innovation network (O12)

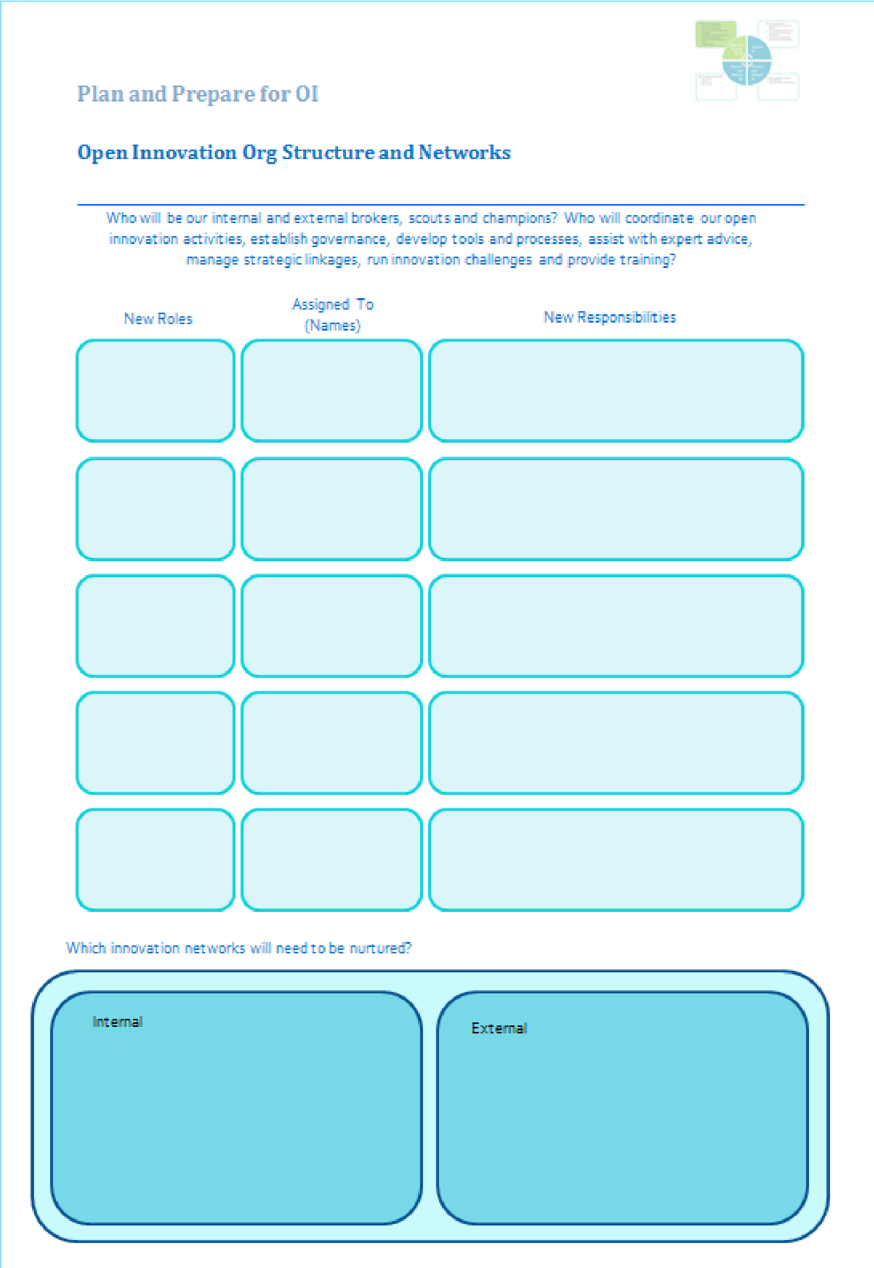
Our Open Innovation model (or planned model) can best be represented by



A central team driving Open Innovation	Various teams across the organisation driving Open Innovation	Responsibility is shared among everyone
☐	☐	☐

Some challenges we will need to address implementing this model will be

FIGURE 8-12: OPEN INNOVATION ORGANISATIONAL STRUCTURE AND NETWORKS (PAGE 1)



Plan and Prepare for OI

Open Innovation Org Structure and Networks

Who will be our internal and external brokers, scouts and champions? Who will coordinate our open innovation activities, establish governance, develop tools and processes, assist with expert advice, manage strategic linkages, run innovation challenges and provide training?

New Roles	Assigned To (Names)	New Responsibilities

Which innovation networks will need to be nurtured?

Internal	External

FIGURE 8-13: OPEN INNOVATION ORGANISATIONAL STRUCTURE AND NETWORKS (PAGE 2)

Adopting open innovation requires employees to be equipped with new skills to effectively engage in open innovation activities. The following template helps to identify any training interventions that may be required. Considering the mechanisms such as introspective and extrospective (in the detailed notes) will help form these training and upskilling requirements.

Plan and Prepare for OI

Open Innovation Development

Context	Interaction	Mechanism	Outcome
The Process of Open Innovation Development (C13)	Requires the training of new open innovation skills to employees (I13.1; L,T,D)	Being introspective, extrospective, interactive and technical (M13.1)	Creating a blend of available skills for an organisational open innovation mindset (O13)

What are our training requirements to enable Open Innovation in our organisation?

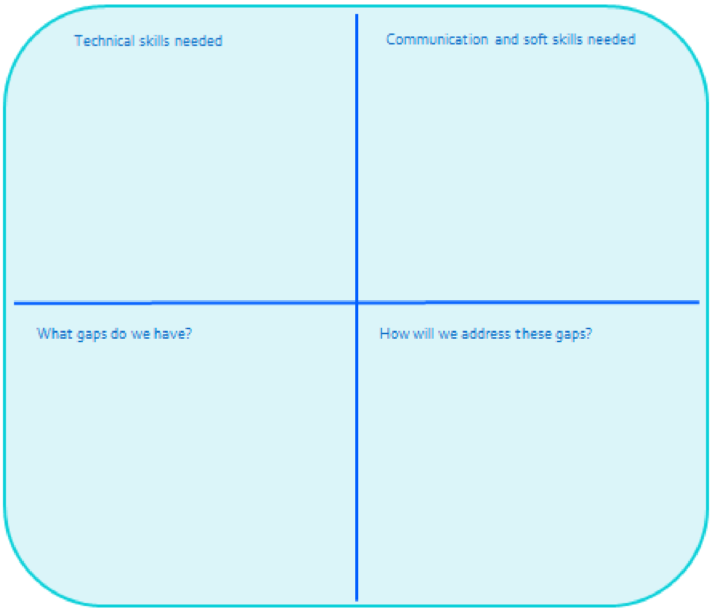


FIGURE 8-14: OPEN INNOVATION DEVELOPMENT

The next template is a final checklist before launching into the open innovation execution phase. It asks questions to the SME to consider and make a final decision to move forward. The objective is not necessarily to have 'yes' answers to all the questions, but to at least consider all the questions and previous 'Plan and Prepare for OI' templates to set up the organisation for success.

Plan and Prepare for OI

Open Innovation Enabling Factors

Context	Interaction	Mechanism	Outcome
Open Innovation Enablement requires Enabling Factors (C14)	Such as the implementation of clear policies (I14.1), managing change (I14.2) and a final readiness assessment (I14.3)	Strengthening governance (M14.1) and leveraging industry change frameworks (M14.2) and readiness checklists (M14.3)	For an enabling environment to execute Open Innovation (O14)

Have we considered everything in our checklist below?

	For Proposers...	For Seekers...
DEFINITION	Can you define what you offer to external partners on your own? Or is the knowledge you wish to share more of the sort where your new partners have to share their needs first before relating to them?	Can you define the idea / knowledge you are looking for? Is it something specific related to a well-defined problem? Or are you looking for a surprise instead?
VISIBILITY	Do you know your strengths? Do others know your strengths? Enough to make them consider you a partner? Are you visible enough for external partners?	Do you know where to look for possible new ideas? Are you able to motivate external thinkers to visit you and share their ideas? Or do you have to hunt for the new external ideas on your own?
COMMON BENEFIT	Have you any idea how to come to a win-win agreement with your partner candidates? What would you offer for your future partners? What is going to be your benefit?	
PROTECTION	Do you have the measures to protect the rights and interests of both parties while coming to this agreement? Did you consider intellectual property issues thoroughly? Are there certain things you should avoid sharing?	
METHODOLOGY	Who is going to be responsible for keeping the established cooperation alive? Can you work together continuously with external partners on a solution? Are your employees accepting external ideas to use them as their own? Who is covering the costs of the collaboration (being available, etc.)?	
STRATEGY	Have you defined what you want to achieve through Open Innovation? Has it been clearly communicated to the organisation? Do you understand your chosen method of engagement and where you want to open up your innovation efforts?	
OIL FRAMEWORK	Have you reviewed all the sections of the OIL Framework under Enabling Open Innovation? Do you have dedicated resources for the implementation, execution and improvement of Open Innovation?	

Are we ready to proceed? Yes No

Adapted from OPINET – OPEN INNOVATION BEST PRACTICE GUIDE

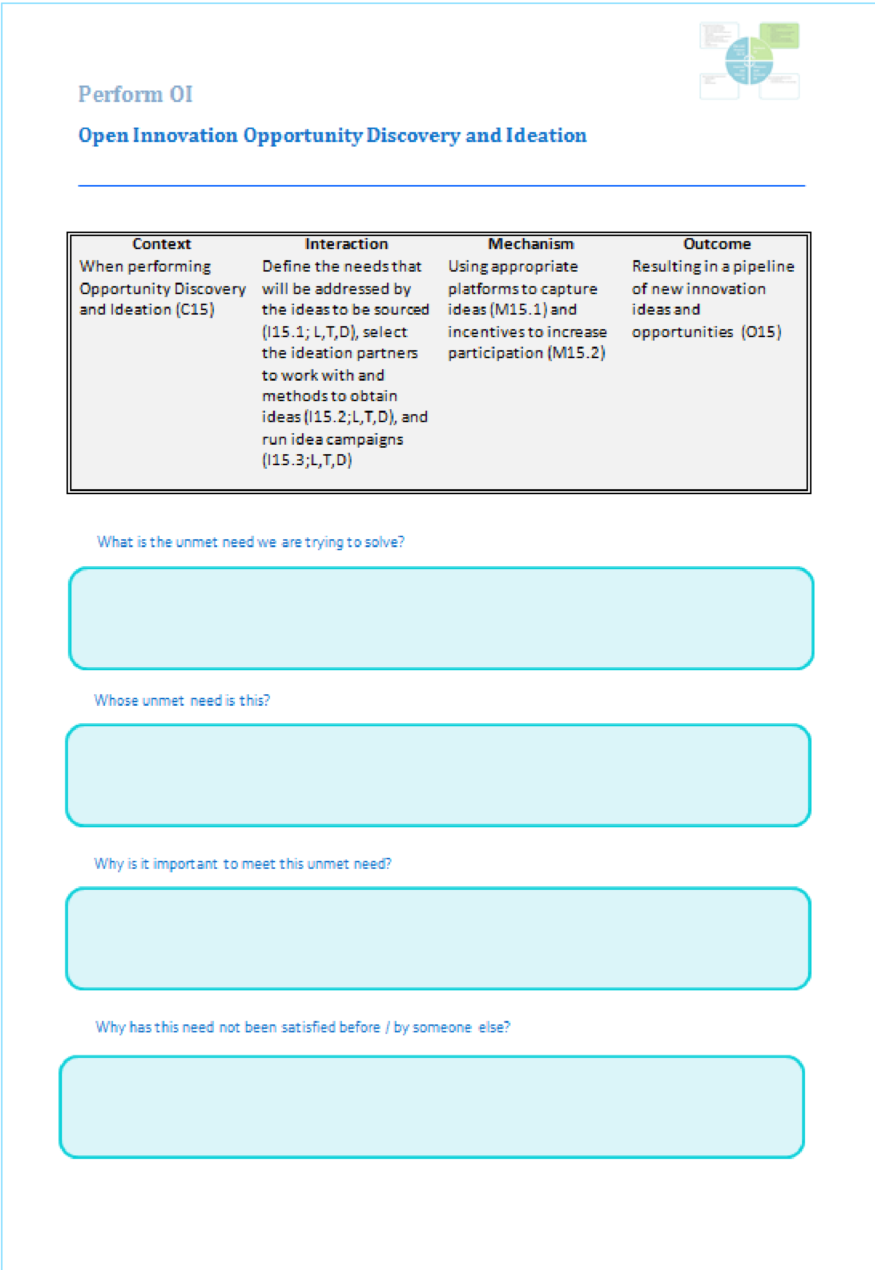
FIGURE 8-15: OPEN INNOVATION ENABLING FACTORS

8.3.2.3 Perform OI

The next five templates guide the SME through the innovation process – what to consider when developing a new innovation from ideation to commercialisation and exploitation. Completion of the 'Perform OI' templates will depend on the innovation approach selected in the previous phase. If an organisation has decided to follow an inside-out only approach, then some of the templates in the beginning of the innovation process will not be very relevant, since they will perform those stages in a closed manner. Some of the questions in the templates could, however, still be relevant for SMEs to answer, even if those steps are to be performed internally without any external input. The explanation of the following templates assumes that these templates will be used for completeness.

The first template in this phase, starting off the open innovation process, considers the customer need that the organisation is trying to address and then builds up a picture of where the organisation would need help to satisfy that need. It considers the type of partnership requests that will be explored, who will be approached for partnership and collaboration (such as a defined group of customers), how the participants will be incentivised and what technology will be leveraged for the interaction. This will effectively kick off the open innovation process.

Depending on the needs of the organisation, they may only complete one template for one innovation or have multiple templates to address different needs and therefore have multiple innovation initiatives running in parallel.



Perform OI

Open Innovation Opportunity Discovery and Ideation

Context	Interaction	Mechanism	Outcome
When performing Opportunity Discovery and Ideation (C15)	Define the needs that will be addressed by the ideas to be sourced (I15.1; L,T,D), select the ideation partners to work with and methods to obtain ideas (I15.2;L,T,D), and run idea campaigns (I15.3;L,T,D)	Using appropriate platforms to capture ideas (M15.1) and incentives to increase participation (M15.2)	Resulting in a pipeline of new innovation ideas and opportunities (O15)

What is the unmet need we are trying to solve?

Whose unmet need is this?

Why is it important to meet this unmet need?

Why has this need not been satisfied before / by someone else?

FIGURE 8-16: OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 1)

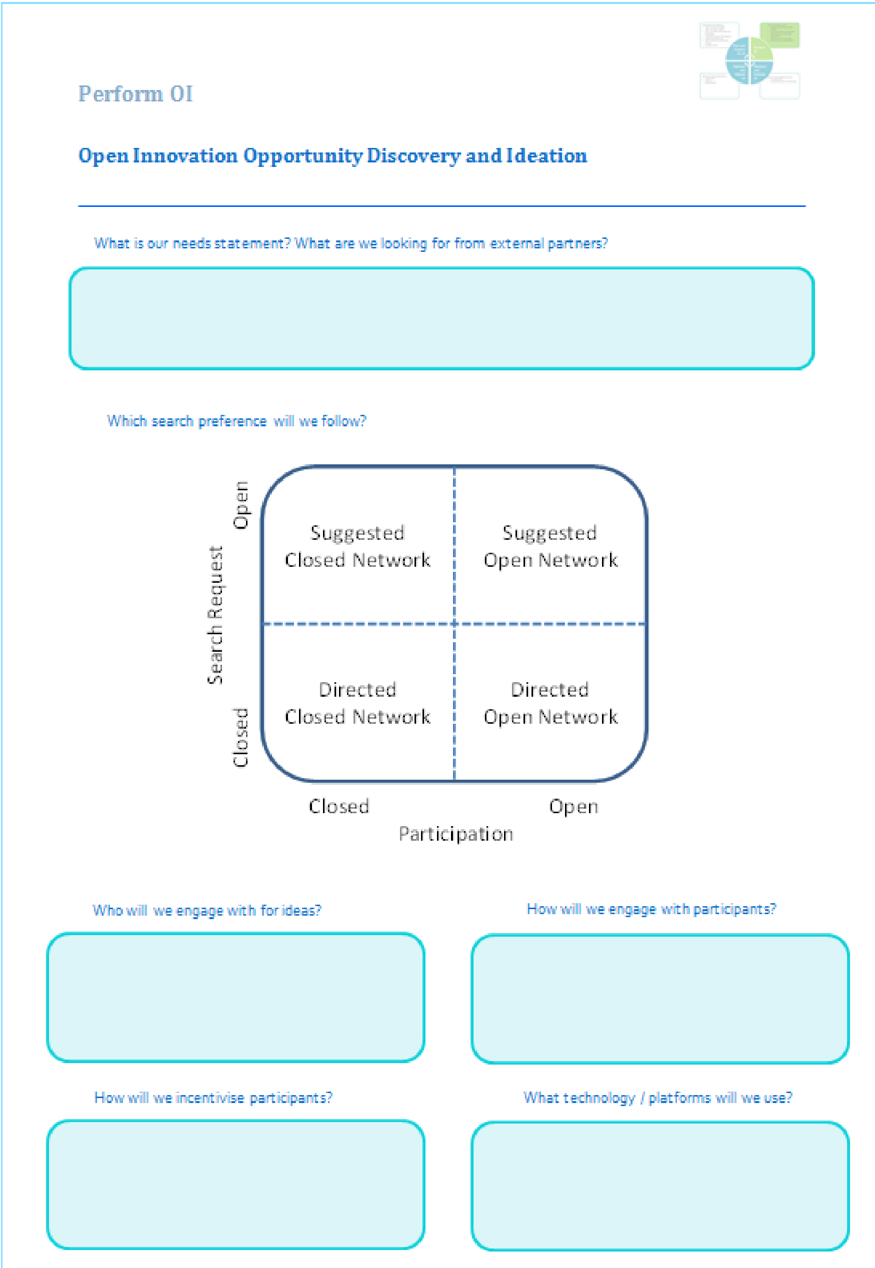
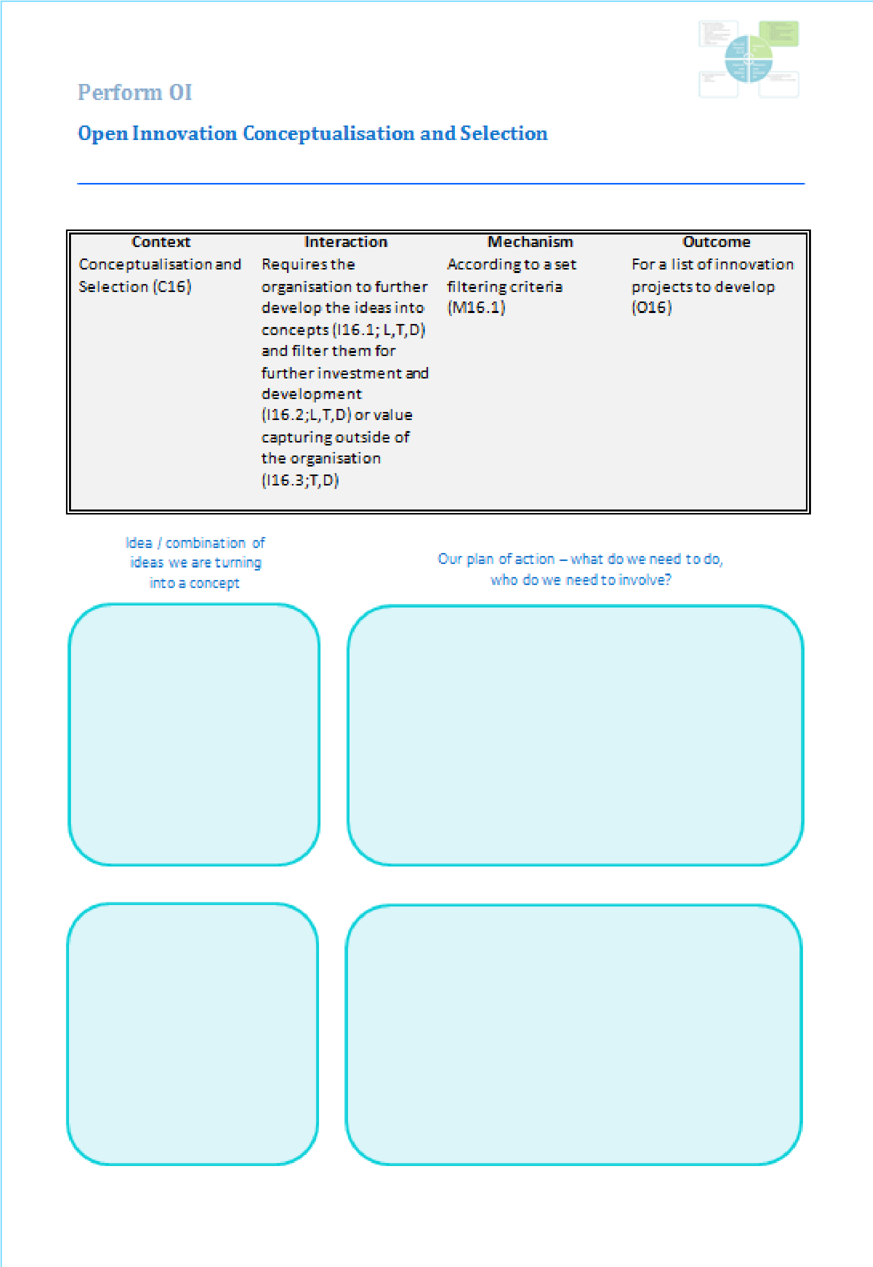


FIGURE 8-17: OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 2)

At the concept stage, the SME will develop the idea further into a concept or prototype which can be used to make a go/no-go decision to develop it further. Developing the idea further may require input from innovation partners as to which ideas need to be defined in terms of roles and activities. It may also be that several ideas are grouped together to form a single concept.


Perform OI

Open Innovation Conceptualisation and Selection

Context	Interaction	Mechanism	Outcome
Conceptualisation and Selection (C16)	Requires the organisation to further develop the ideas into concepts (I16.1; L,T,D) and filter them for further investment and development (I16.2;L,T,D) or value capturing outside of the organisation (I16.3;T,D)	According to a set filtering criteria (M16.1)	For a list of innovation projects to develop (O16)

Idea / combination of ideas we are turning into a concept

Our plan of action – what do we need to do, who do we need to involve?

FIGURE 8-18: OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 1)

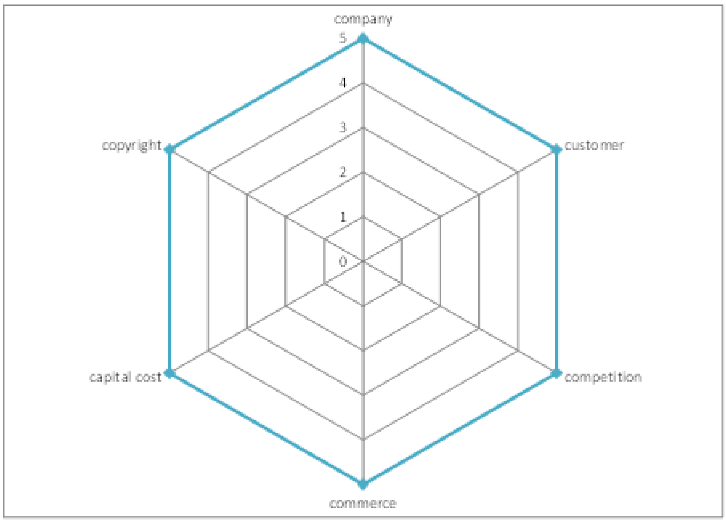
The second template under Conceptualisation and Selection focuses on the selection of the concept that will be developed further in the next stage. The concepts are assessed against set criteria to identify the best candidates for development investment. The SME could decide to use other criteria than those provided, but this gives them an initial framework to consider. A template will be completed for each concept.

Perform OI

Open Innovation Conceptualisation and Selection

We need to filter concepts for promotion to our development phase. How does the concept score on the following criteria?

CONCEPT NAME:____



Company: Strategy fit, competitive context, prevailing economics, and positioning within the value chain

Customer: Utility, customer preference, addressing a problem to solve

Competition: Uniqueness of the opportunity, competitive advantage

Commerce: Market size, market barriers, growth opportunity

Capital Cost: Internal capability to leverage, investment costs and time

Copyright: Intellectual Property mechanisms, ease of protection, cost of protection

Note: also consider completing a business model canvas and or value proposition canvas for your concept to help understand the potential of your innovation.

FIGURE 8-19: OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 2)

If there are concepts the SME decides not to take into development, but which have value within the inside-out open innovation process, then these can be identified and a decision made as to how value will be captured from them.

Perform OI

Open Innovation Conceptualisation and Selection

Are there any concepts that we can benefit from by pursuing an inside-out approach?

CONCEPT NAME: ____________________

Value Capturing Method:

- Spin out into separate business ☐
- License to external parties ☐
- Sell to external parties ☐
- Free revealing ☐
- Other: ____________ ☐

CONCEPT NAME: ____________________

Value Capturing Method:

- Spin out into separate business ☐
- License to external parties ☐
- Sell to external parties ☐
- Free revealing ☐
- Other: ____________ ☐

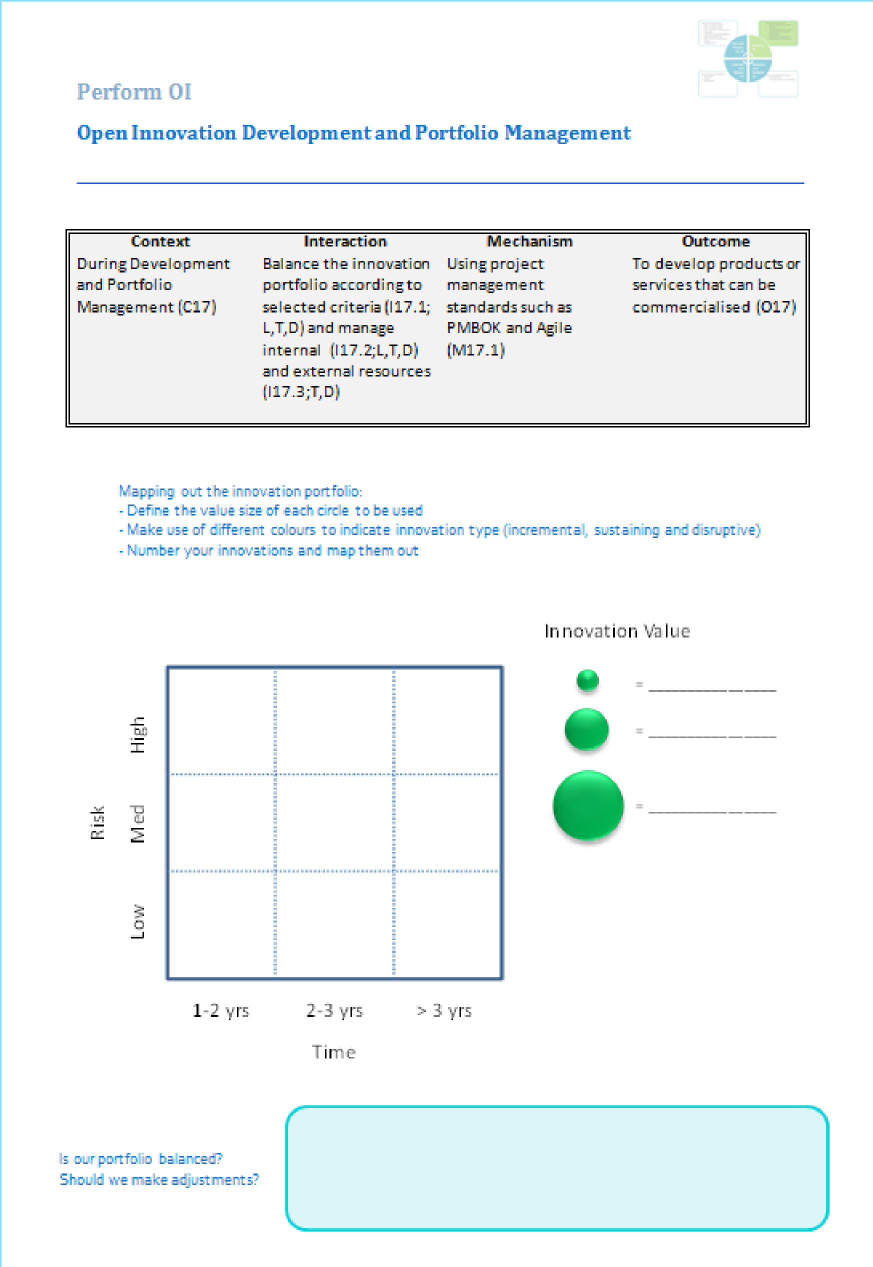
CONCEPT NAME: ____________________

Value Capturing Method:

- Spin out into separate business ☐
- License to external parties ☐
- Sell to external parties ☐
- Free revealing ☐
- Other: ____________ ☐

FIGURE 8-20: OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 3)

For many SMEs, managing innovation initiatives as a portfolio may be a new concept. Some SMEs might also only have a limited number of projects in their development pipeline at any given moment, so this may seem unnecessary. However, applying these management methods to the innovation process will provide better insight to the SME regarding alignment to their innovation and strategic objectives. Also, it will give an indication of the type of risk/reward the SME is taking on given the chosen projects. The first template maps innovation initiatives in a portfolio view.



Perform OI

Open Innovation Development and Portfolio Management

Context	Interaction	Mechanism	Outcome
During Development and Portfolio Management (C17)	Balance the innovation portfolio according to selected criteria (I17.1; L,T,D) and manage internal (I17.2;L,T,D) and external resources (I17.3;T,D)	Using project management standards such as PMBOK and Agile (M17.1)	To develop products or services that can be commercialised (O17)

Mapping out the innovation portfolio:
- Define the value size of each circle to be used
- Make use of different colours to indicate innovation type (incremental, sustaining and disruptive)
- Number your innovations and map them out

Is our portfolio balanced?
Should we make adjustments?

FIGURE 8-21: OPEN INNOVATION DEVELOPMENT AND PORTFOLIO MANAGEMENT (PAGE 1)

The second template creates a project charter for each innovation initiative, bringing in a business management method to provide more structure and visibility to managing the innovation development process. It provides clarity on the intent of the project and the resource requirements to deliver the project.

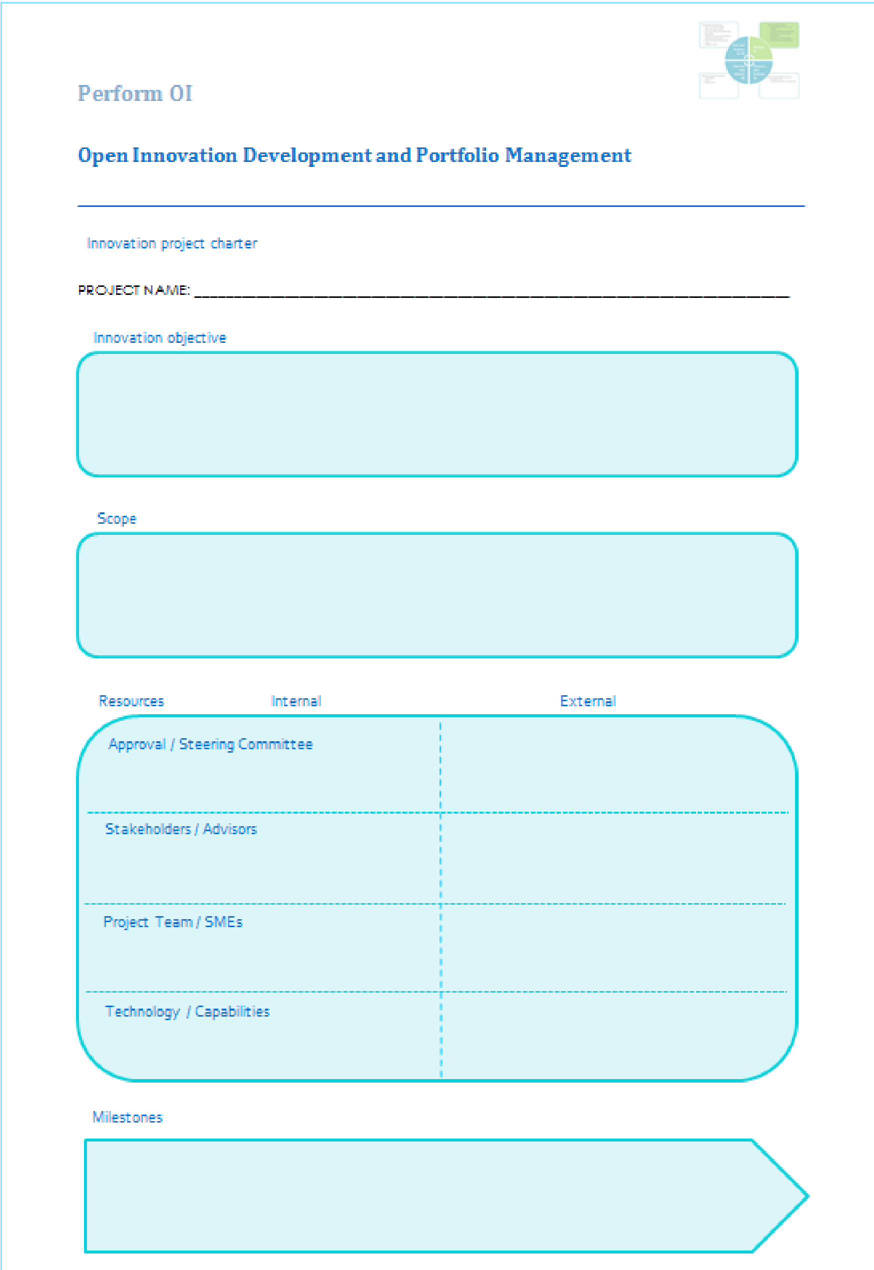


FIGURE 8-22: OPEN INNOVATION DEVELOPMENT AND PORTFOLIO MANAGEMENT (PAGE 2)

When the innovation is ready to be deployed into the market, then the SME can use an inside-out, outside-in or coupled process to execute this stage. Based on the process chosen, activities and responsibilities must be assigned to the appropriate parties. IP protection must also be considered, referring back to the IP framework decisions made in the 'Enablement' phase of the open innovation approach.

Perform OI

Open Innovation Deployment and Protection

Context	Interaction	Mechanism	Outcome
To Deploy a new innovation into the market (C18)	The organisation will take sole or joint ownership depending on the innovation strategy adopted (I18.1; L,T,D) and the innovation protected (I18.2;L,T,D)	Through the adoption of deployment practices (M18.1) and IP frameworks (M18.2)	To achieve successful deployment (O18)

For deployment of a new innovation into the market:

What is our marketing and communication plan?

How have our suppliers and supply chain partners been prepared?

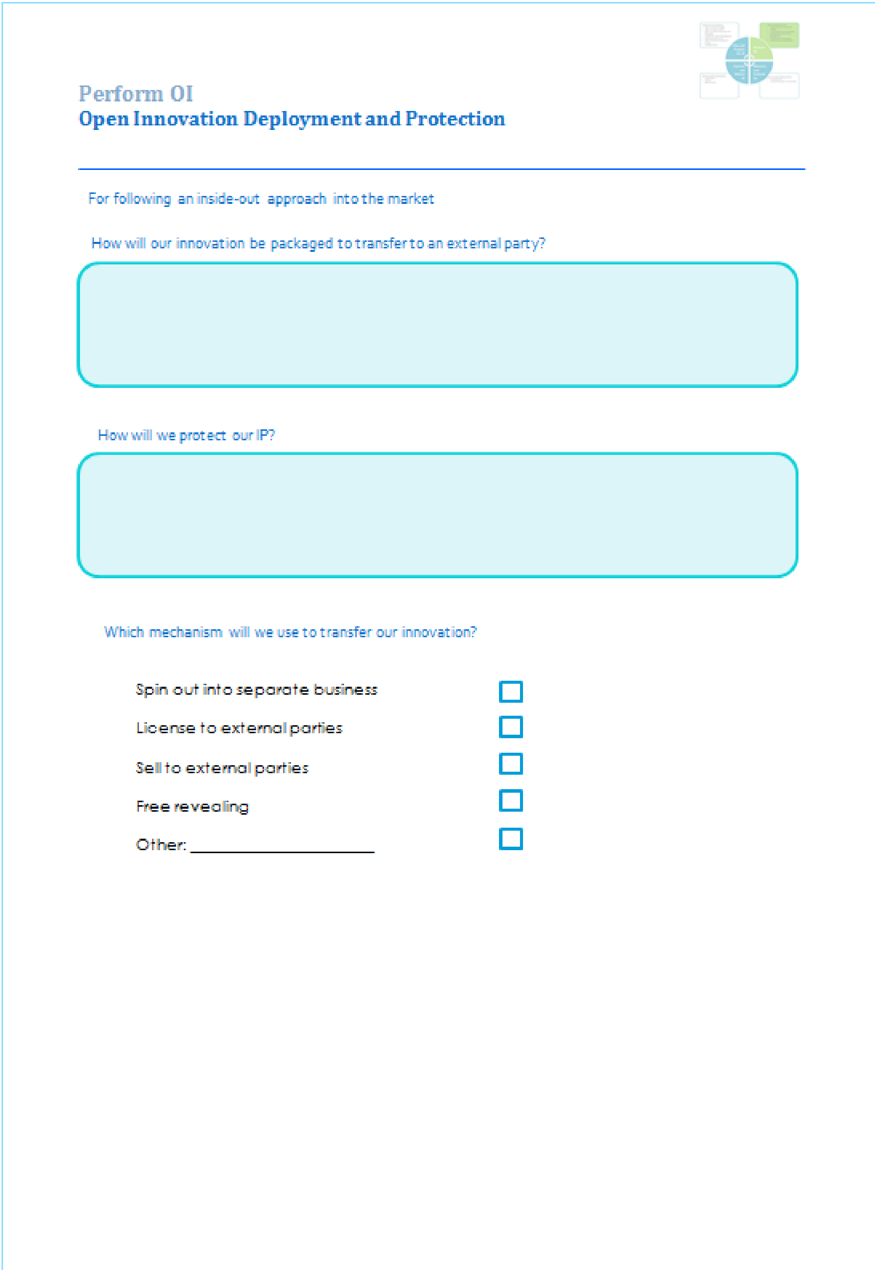
How will we operationally support the new innovation? Sales, operations, customer service, etc.

What are the critical tasks we need to focus on during the first 30 days of launch?

How are we protecting our innovation? ____

FIGURE 8-23: OPEN INNOVATION DEPLOYMENT AND PROTECTION (PAGE 1)

The second template focuses on the inside-out process where an external party will take the innovation to market.



Perform OI
Open Innovation Deployment and Protection

For following an inside-out approach into the market

How will our innovation be packaged to transfer to an external party?

How will we protect our IP?

Which mechanism will we use to transfer our innovation?

- Spin out into separate business ☐
- License to external parties ☐
- Sell to external parties ☐
- Free revealing ☐
- Other: ____________________ ☐

FIGURE 8-24: OPEN INNOVATION DEPLOYMENT AND PROTECTION (PAGE 2)

The last stage in the open innovation process is to identify further opportunities to extract value from the innovation, either through exploitation or exploration. The template provides questions the SME can consider and boundary views that can lead to new areas of value. This template will most likely not be considered directly after the previous stage, but may require a substantial time lapse for the initial innovation to be stabilised and to extract its initially intended value.

Perform OI

Open Innovation Exploitation and Exploration

Context	Interaction	Mechanism	Outcome
Searching for additional value through Exploitation and Exploration (C19)	Requires the organisation to find opportunities (I19) within current and new customers, markets, channels, knowledge and business models	Considering existing boundaries (M19.1) and new extended boundaries (M19.2)	Resulting in increased appropriated value (O19)

To exploit and explore, consider the following:

Using your current product (or service) as starting point -

Product Improvement: improve attributes (such as colour, materials, performance or speed) or add new features that customers want (new functionality, premium models, etc.).

New customers, channels, markets: which customers can you target that are currently not using your product? Which additional channels can you use (digital, physical) and what markets can you also move into (lower, premium, international)?

New integrated application: Who else can use your product, either in a different application or in combination with their own to provide an improved value proposition? Can it be sold or licensed?

New business models: Can we develop a new business model around our product or service to better serve customers, appropriate more value and disrupt the market?

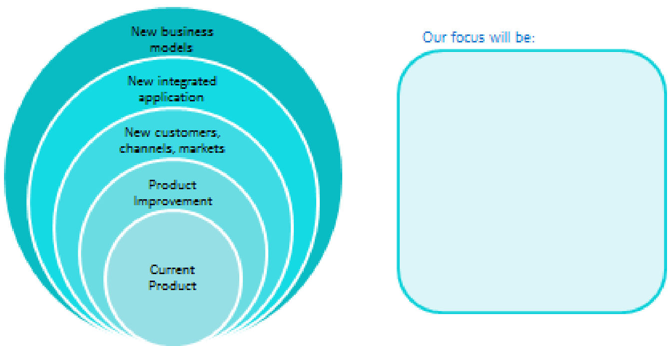


FIGURE 8-25: OPEN INNOVATION EXPLOITATION AND EXPLORATION

8.3.2.4 Measure and Evaluate OI

The two 'Measure and Evaluate OI' templates consider the KPIs for measuring the performance of the open innovation approach and provide opportunity to identify possible areas that can be improved. The first template provides a selection of KPIs that the SME can adopt for measurement. The more measurements the SME selects, the more effort would be required to measure these different points, so the SME must decide how much time and effort can be committed to obtain the appropriate benefit.

Measure and Evaluate OI

Open Innovation KPIs

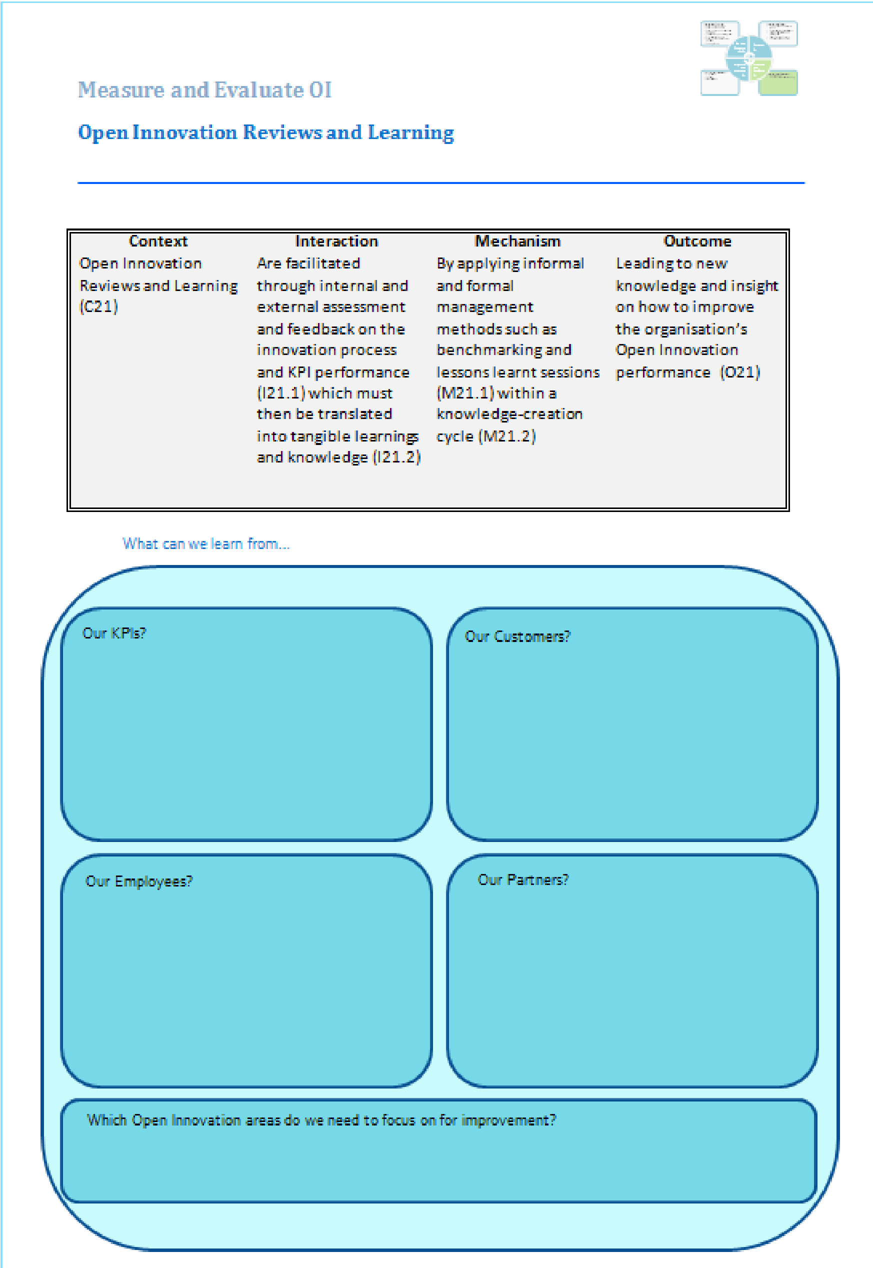
Context	Interaction	Mechanism	Outcome
Innovation KPIs for Open Innovation (C20)	Must be organisation-specific, supporting chosen goals and methods (I20.1) and can include financial, input, process, output and outcome KPIs as appropriate (I20.2)	Selected from measurement models and measurement categories (M20.1)	To measure and determine innovation performance (O20)

Our Open Innovation KPIs will include:

KPI		KPI	
Investment in Open Innovation		Number of OI ideas launched	
Percentage of staff trained on OI		OI ideas launched as percentage of all ideas taken to market	
Number of registered users on the OI platform		Number of patents through OI projects	
Number of innovation ideas submitted		Revenue generated through OI projects	
Percentage of Management trained on OI		Revenue of OI as percentage of total revenue	
Freedom given by top management to establish search fields outside of the core business		Percentage of OI failures (not launched; not successful)	
Number of unique participants submitting ideas		Revenue generated through IP licensing/sales	
Percentage of 'usable' ideas compared to total number of ideas submitted		Customer satisfaction of new OI products and services (fit to market)	
Percentage of OI ideas in innovation pipeline vs closed innovation ideas		New market/sales/customers growth through OI products and services	
Number of (active) innovation partners		ROI comparison (OI vs closed innovation)	
Diversity of innovation partners		OI portfolio ratios	
Time to respond to new ideas/solutions		Other:	
Time to market of the innovation		Other:	
Average number of ideas per participant		Other:	
Degree of IP protection (number of ideas protected; number of IP disputes)		Other:	

FIGURE 8-26: OPEN INNOVATION KPIs

The next template assesses the KPI performance and feedback from customers and other innovation partners to identify which areas of the innovation approach could be improved. The assessment can then feed into the continuous improvement cycle. The SME will have to decide 'what good looks like' for them, based on their own innovation goals and organisational constraints. Benchmarking can be used for comparison, but these measures may be industry-specific and not always applicable or available for the SME's situation. Management discretion will then be required.



Measure and Evaluate OI

Open Innovation Reviews and Learning

Context	Interaction	Mechanism	Outcome
Open Innovation Reviews and Learning (C21)	Are facilitated through internal and external assessment and feedback on the innovation process and KPI performance (I21.1) which must then be translated into tangible learnings and knowledge (I21.2)	By applying informal and formal management methods such as benchmarking and lessons learnt sessions (M21.1) within a knowledge-creation cycle (M21.2)	Leading to new knowledge and insight on how to improve the organisation's Open Innovation performance (O21)

FIGURE 8-27: OPEN INNOVATION REVIEWS AND LEARNING

8.3.2.5 Improve and Mature OI

The last template in the series relates to the 'Improve and Mature OI' phase of the framework. It selects improvement actions to implement to enhance the open innovation capability and effectiveness, or advance the organisation to the next level of innovation maturity. The template allows the SME to come up with various improvement options that could be selected and apply a selection criteria to decide which of the options will be adopted, given resource constraints and other considerations. Not all the options may therefore be implemented. This will lead into a further cycle of the open innovation approach.

Improve and Mature OI

Open Innovation Improvement

Context	Interaction	Mechanism	Outcome
For Open Innovation Improvement (C22)	Review the outcomes from your Review and Learning exercise (I22.1) and develop improvement options (I22.2) for adoption (I22.3)	Drawing from the best practice notes and previous design propositions in each OIL Framework sub-element (M22.1), additional improvement techniques (M22.2) and adoption selection criteria and management decisions	Improving the organisation's Open Innovation capability and maturity (O22) and Leading into another OIL Framework cycle (O23)

Which improvements will we adopt?

Improvement Option	Benefit	Time	Cost	Other Criteria:	Adopt
Organisation					
Process					
Measurement					

FIGURE 8-28: OPEN INNOVATION IMPROVEMENT

8.4 The Open Innovation Approach

The previous sections outlined the three design iterations followed in the methodology resulting in:

- An Open Innovation Framework (chapter 6)
- Open Innovation Design Propositions and Descriptions notes (chapter 7)
- Open Innovation User Templates (chapter 8)

The open innovation approach is therefore the culmination of the outputs from the design iterations into an approach that an SME can use to implement, execute and improve open innovation in their organisations. When the SME embarks on this journey, the user can start with the templates to guide them in using the approach. The templates provide a simplified interface for the SME that includes the framework and each design proposition, together with key questions to answer related to the particular framework element. When more information and detail is needed on the element decision items or mechanisms in the templates, then the description notes can be consulted that will provide further detail and tools on the relevant topic. The reverse is also possible where the SME can work through all of the detail first to become more familiar with the approach and different concepts and tools and then move towards using the templates. The approach is flexible enough to accommodate both scenarios.

The templates, framework, propositions and design descriptions therefore provide different levels of detail and abstraction within the approach. Combining all the artefacts in the approach brings about a way for SMEs to implement, execute and improve open innovation within their organisations, addressing the main research objective of this thesis:

MRO: To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.

8.5 Chapter Conclusion

This chapter concludes the design cycles within the design sciences method used within this research study, resulting in an open innovation approach for SMEs. The approach combines the design cycle artefacts – the OIL Framework, the design propositions and descriptions, and the open innovation templates – to form the open innovation approach, thereby concluding step 3 of the methodology (Design and Develop) as discussed in chapter 2.

The open innovation approach fulfils the design sciences methodological requirement of producing artefacts in the form of constructs, models and methods (Peffers et al., 2008) by means of the OIL Framework, design propositions and open innovation templates. A further aim of design sciences research is to develop "knowledge to solve field problems", (Denyer et al., 2008). The developed knowledge artefacts resulting in the open innovation approach aim to solve the field problem described in chapter 1 and meet the main research objective defined in chapter 2. However, it requires further validation to understand the effectiveness of the approach. The following chapter will therefore discuss the fourth step in the research method and look at validation and verification of the approach.

Chapter 9: Verification and Validation

9.1 Approach to Verification and Validation

The importance of evaluating the design output in design science research was highlighted in the research methodology set out in chapter 2. Hevner et al. (2004) prescribed that "the utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods". Further, Venable et al. (2012) stated the purpose of evaluation was to "evaluate an instantiation of a designed artefact to establish its utility and efficacy (or lack thereof) for achieving its stated purpose". In addition, reasons for evaluation sited by Venable et al. (2014) are the substantiation of design theory in terms of the quality of the knowledge outcomes (Baskerville et al., 2007) to provide evidence that the theory leads to some developed artefact that will be useful for solving a problem or making an improvement, or to establish whether the new artefact adds to or improves the state of the art.

9.1.1 Validation Methods Used

For the evaluation of the open innovation approach, a multi-faceted approach was taken. Firstly, a requirements adherence verification matrix was used to compare the design requirements defined in chapter 5 against the open innovation approach. This verified if the design requirements derived from the open innovation study of South African SMEs and from the literature were met by the developed open innovation approach.

Illustrative scenarios were also discussed, providing a view on how the approach would be applied in a real-world scenario (conceptually to test suitability), without the need and risk of an actual implementation (testing effect). A complete scenario was added as a reflective review, covering the full cycle of the OIL Framework. A partial scenario was also discussed that was conducted with an SME, covering the first section of the framework (Enabling Open Innovation) which was completed as an actual case to test feasibility not just on a conceptual level, but an actual application.

The open innovation approach was also peer-reviewed by experts (academics and practitioners) and by potential users (SMEs). This was done using a survey that was sent out, using a Likert scale and commentary space, to receive feedback. Questions were aligned to the design requirements as well as general questions to assess usefulness and completeness. This provided good feedback on the overall approach, giving different perspectives, both from an academic and theoretical perspective and from a practical user and application perspective. Skype interviews were also conducted during this review. Feedback received provided input into either immediate enhancements that could be considered for incorporation or topics for future research to further develop the approach.

9.2 Requirements Adherence Verification Matrix

In chapter 5, design requirements were developed for the open innovation approach. As part of the validation process, the approach must be tested against the design requirements to strengthen the evaluation of the artefacts (Gous, 2014).

To perform the evaluation, a requirements adherence verification matrix was developed to review adherence to the requirements.

TABLE 9-1: REQUIREMENTS ADHERENCE VERIFICATION

#	Design Requirement	Addressed	Notes
U1	*Requirement:* The approach should consider the context of the South African SME, specifically its constraints, such as number of employees, and access to resources.	Yes	The approach makes use of CIMO-logic that considers the context within which to apply recommended actions. References are also made to the South African context where appropriate during the development of the design propositions (chapter 7). The design requirements (chapter 5) also considered the open innovation survey of South African SMEs (chapter 4).
U2	*Requirement:* The user should be allowed flexibility to apply their own discretion when using the approach.	Yes	The approach provides options to the user that can be implemented based on their own context and strategic decision (see section 7.4.1 in chapter 7). This is further validated in chapter 9 in section 9.5.2. question 1.5 from Table 9-2.
U3	*Requirement:* The approach should be user-friendly – i.e. easy to adopt, understandable, and easy to use.	Yes	The approach makes use of the templates to provide easier use. Feedback in section 2 also confirmed that this requirement is met (section 9.5.2 questions 1.3, 5.1 and 5.3 from Table 9-2 in chapter 9).
U4	*Requirement:* The approach should be considered as a management aid for implementing open innovation within SMEs.	Yes	Feedback from the illustrative scenario cases shows that the approach can be used as a management aid. This was further supported in the feedback from the SMEs and subject matter experts (Question 1.6 Table 9-2 in chapter 9).
U5	*Requirement:* The approach should support repeated and continued use.	Yes	The approach follows an iterative cycle based on the PDCA model that supports continued use versus an ad hoc or once-off approach (section 2 chapter 6 and Question 1.7 in Table 9-2, chapter 9).
U6	*Requirement:* The approach should provide clear definitions and explanations.	Yes	The approach provides user templates for ease of use, supported by the design propositions and description notes

#	Design Requirement	Addressed	Notes
			(chapter 7 and chapter 8; also Questions 1.8 and 5.3 in Table 9-2, chapter 9).
F1	*Requirement:* The approach should lead to improved open innovation capability and execution within SMEs.	Yes	Feedback from the SMEs and subject matter experts confirmed that the approach should help with improved open innovation capability and execution within SMEs (Questions 4.1 and 5.1 in Table 9-2 as well as sections 9.4 and 9.6 in chapter 9).
F2	*Requirement:* The approach should cover the end-to-end life cycle of innovation, from ideation to commercialisation, for both inbound and outbound open innovation.	Yes	The approach is based on the OIL Framework which includes preparing for innovation (innovation enablement), the innovation process from ideation to commercialisation and exploitation, and the measurement and improvement of innovation (chapter 6). It also considers inbound, outbound and combined innovation in the selection process (Design proposition 7 in chapter 7). See also Questions 1.1 and 5.2 from Table 9-2 in chapter 9 to support this requirement.
F3	*Requirement:* The approach should cover not only the innovation process but also the organisational factors that enable innovation.	Yes	The first section of the OIL Framework focuses on organisational factors for innovation enablement such as organisation structure, strategy and culture (sections 6.4 and 6.6 in chapter 6 and section 7.4.1 in chapter 7).
F4	*Requirement:* The approach should provide business management method principles that can be applied within open innovation.	Yes	Business management methods are incorporated into the approach to increase the innovation management rigour and was derived from the literature synthesis throughout chapters 6 and 7 in developing the OIL Framework and the Design Propositions. (For examples see section 6.2 in chapter 6 and 7.4 in Chapter 7).
F5	*Requirement:* The approach should include multiple open innovation	Yes	The open innovation survey (section 4.4.3 in chapter 4) indicated various

#	Design Requirement	Addressed	Notes
	options to be pursued, based on the innovation requirements and strategy of the SME.		preferred open innovation options. The approach includes these preferred and other alternative options for selection (Design Proposition 8 in chapter 7).
F6	*Requirement:* The intent of the approach should be for organisations that want to apply open innovation, although it should be recognised that there can be varied degrees of openness.	Yes	The approach makes provision for which open innovation methods are used and where in the innovation process they are applied – where the organisation opens up (section 7.4 in chapter 7).
F7	*Requirement:* The approach should provide recommendations on the type of open innovation selection, in order to increase the chances of open innovation success.	Yes	The approach provides various open innovation types for selection in the design requirements detailed notes (sections 7.4.1 and 7.4.2 in chapter 7).
F8	*Requirement:* The approach should be useful for various sectors and innovation types.	Yes	The approach is not limited to any specific sector or innovation type. It is generic enough to be applied regardless of industry (Question 1.9 in Table 9-2, chapter 9).
F9	*Requirement:* The approach should include or recommend tools and aids to assist with executing open innovation.	Yes	The detailed notes from the literature review provide recommendations on various tools to use during the open innovation approach (chapter 7).
F10	*Requirement:* The approach should consider the innovation maturity level of the organisation.	Yes	Three levels of maturity were indicated to describe the levels of interaction in the approach as defined in section 7.3 in chapter 7.
F11	*Requirement:* The approach should cover the implementation, execution and improvement of open innovation.	Yes	The approach covers all three phases as set out in the requirement, both in the OIL Framework through the framework phases (chapter 6) as well as within the design propositions (chapter 7). See also Question 1.1 in Table 9-2 of chapter 9.
R1	*Requirement:* The approach is not meant to include an exhaustive set of tools and methods available for	Yes	The approach is built making use of various (over 80) references that were included from the literature. This

#	Design Requirement	Addressed	Notes
	open innovation, but should be comprehensive enough to provide sufficient relevant options for SMEs.		includes various tools and techniques to assist SMEs in using the approach. See also Questions 3.1, 3.2 and 3.3 in Table 9-2 from chapter 9.
R2	*Requirement:* The approach is intended for SMEs, even though some principles, tools, and methods may be applicable to larger organisations.	Yes	The focus was to develop the approach for SMEs, based on open innovation literature related to SMEs, but also supplemented with literature based on large organisations where it was deemed applicable or where literature specific to SMEs did not exist (see also conclusion in chapter 6).
R3	*Requirement:* The approach is not a legal or legislative guide, and input required for such items (e.g. IP management) should be obtained from specialists within those fields.	Yes	The user is encouraged to obtain specialised legal and legislative guidance, especially on IP management due to its complexity (section 7.4 in chapter 7).
R4	*Requirement:* The approach does not guarantee open innovation success due to the multitude of factors that could influence such an outcome. However, it does provide principles based on theory and practice to increase chances of success when applied.	Yes	The open innovation approach provides a way for SMEs to implement, execute and improve open innovation in their organisations, based on sound theoretical principles (chapters 6 and 7). Feedback during the case studies (Question 4.1 in Table 9-2, chapter 9) also indicated that users feel that the approach provides them with an increased chance of success compared to not using a structured approach.
A1	*Requirement:* Some items to be included in the approach will be discretionary and dependent on factors inherent to the organisation, such as its set-up, size, and strategy. Decisions about how or whether to apply these will therefore differ between organisations. Examples of these include IP agreements and technology use.	Yes	The approach provides flexibility where the user can use their own discretion about the elements to choose based on their own context (Question 1.4 in Table 9-2, chapter 9).

#	Design Requirement	Addressed	Notes
A2	*Requirement:* It is acknowledged that open innovation in SMEs as a formal discipline is still very new, and that the approach to be developed will be based on emerging findings from SMEs and larger organisations. The approach should be seen as a reflection of early best practice within an evolving field of knowledge.	Yes	The literature used in developing the approach incorporated practices from SMEs and large organisations (chapter 6 and chapter 7). Combining the material into an approach for SMEs adds to the development of the field of knowledge (Question 3.3 in Table 9-2, chapter 9 and Section 10.2.2 in chapter 10).
B1	*Requirement:* The approach should be used in a legal and ethical way by the SME.	N/A	These requirements refer to the application of the approach and cannot be controlled by the approach. It has, however, been designed so as not to violate the requirement.
B2	*Requirement:* The approach should not be used to negatively exploit other parties involved in the open innovation process.	N/A	These requirements refer to the application of the approach and cannot be controlled by the approach. It has, however, been designed so as not to violate the requirement.
B3	*Requirement:* The open innovation approach should promote value for all parties involved and assist in establishing trust.	N/A	These requirements refer to the application of the approach and cannot be controlled by the approach. It has, however, been designed so as not to violate the requirement.

The requirements adherence matrix shows that all the requirements set out in chapter 5 have been addressed within the approach.

9.3 Illustrative Cases

In chapter 2 the motivation is provided to make use of illustrative cases as tools for evaluation of the approach. It allows the approach to be evaluated for suitability, without the constraints and potential risks associated with implementation to evaluate effect.

The evaluation performed with the SMEs also serves as a form of illustrative cases. When the approach was discussed with the SMEs, the templates were discussed within the context of the SME and illustrative scenarios explored with them to gain a better understanding of the approach. It was decided not to complete the templates due to the time impact this would have had.

For the purpose of discussion, a complete end-to-end illustrative scenario was completed using the templates for a fictitious SME. Thereafter, a real case was described, covering only the 'Enable Open

Innovation' section of the approach. The first phase of the open innovation approach allows completion without implementation, which supports the requirements for an illustrative scenario, without having any possible implications for the SME completing the templates. The open innovation process would require the SME to implement the innovation, which may require a substantial amount of time and resources to be invested. Having the illustrative cases (as described in chapter 2) therefore achieved a balance between the evaluation requirements of the methodology and the constraints within the research study.

9.3.1 End-to-End Scenario

The end-to-end scenario will make use of the templates within the open innovation approach and describe how the SME can go through the whole approach when implementing open innovation in their organisation. Having the end-to-end illustrative case can also be beneficial for any SME who adopts the approach, as was mentioned by one of the SME participants completing the survey in section 3.

The profile of the SME to be used for the illustrative case can be described as follows:

Name: Heat Sense Technologies

Industry: Manufacturing of technology, producing safety-monitoring devices such as heat and smoke detectors

Number of employees: 23

Years in operation: 6 years

Open innovation maturity: Transitional

The organisation is doing well in its chosen market, but would like to grow its revenue and market share, while facing competition from new digitally enabled competitors. The organisation would like to increase revenue by 20 percent over the next three years and achieve this by taking two new products to market over the next 18 months. They see those to be products that have strong digital and software-application features.

Their risk profile can be described as moderate with an innovation focus in the sustaining category, targeting current and adjacent markets. The organisation has previously done some open innovation and achieved success through this way of innovating. These capabilities are now being established more within their strategy.

Plan and Prepare for OI

Open Innovation Strategy

Context	Interaction	Mechanism	Outcome
When developing an Open Innovation Strategy (C6)	Decide on innovation goals aligned to business strategy (I6.1; L,T,D) and obtain an innovation portfolio view (I6.2; T,D)	Managing investment and risk (M6)	Providing a view of 'what' innovation will be developed (O6)

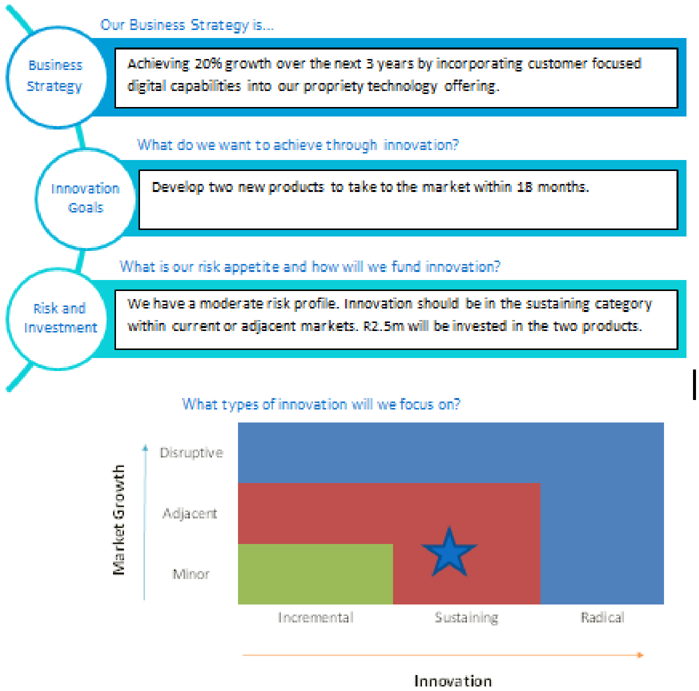


FIGURE 9-1: CASE 1 – OPEN INNOVATION STRATEGY

The organisation has an established innovation process, but this focuses mainly on hardware and electronics. They do not have software-development capability and have limited resources at the moment to dedicate to innovation development. They would have to leverage other skills to help with their innovation plans. They foresee the need to follow a coupled open innovation approach, requiring outside-in and inside-out interventions throughout the innovation process. This will be challenging given their maturity level of Transitional, but can be achieved with the right focus and leadership support.

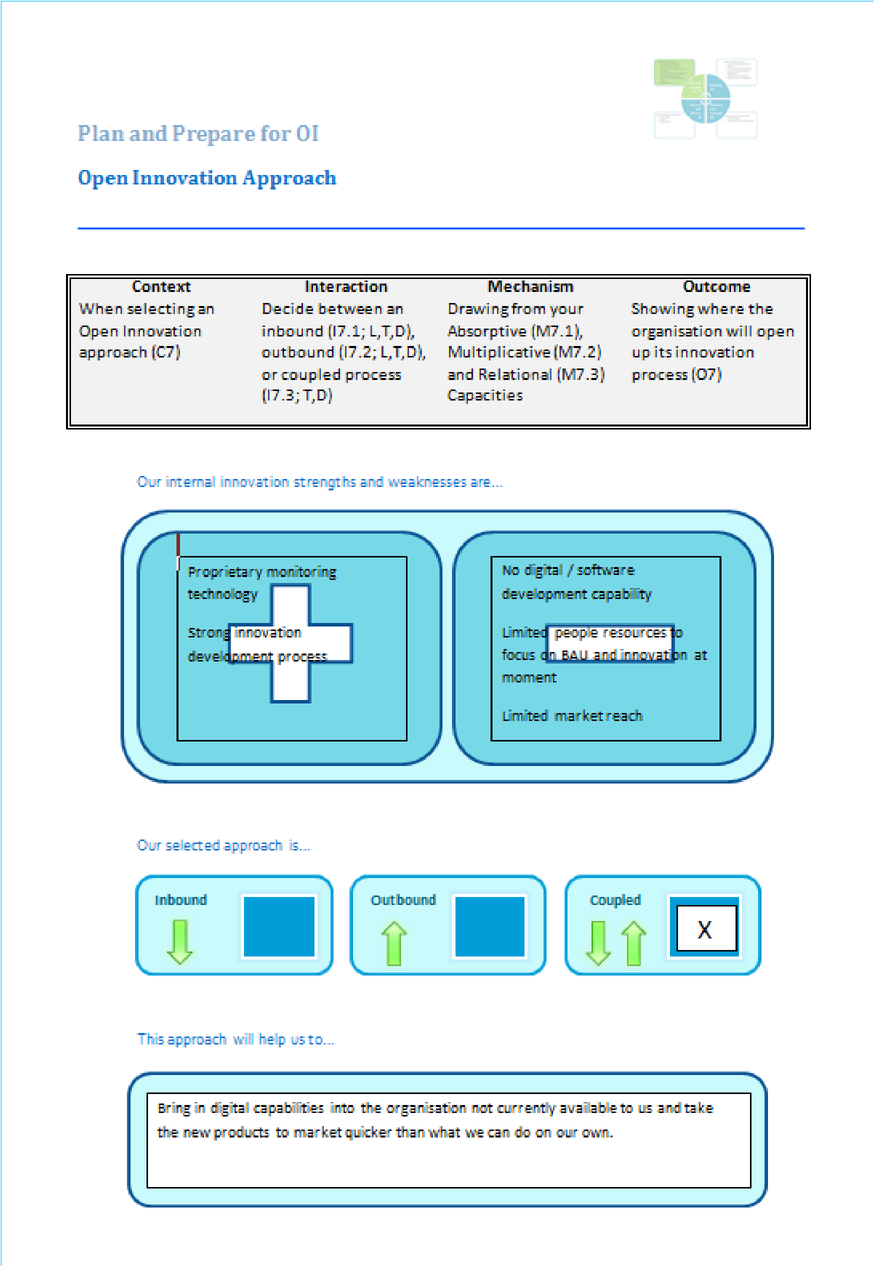
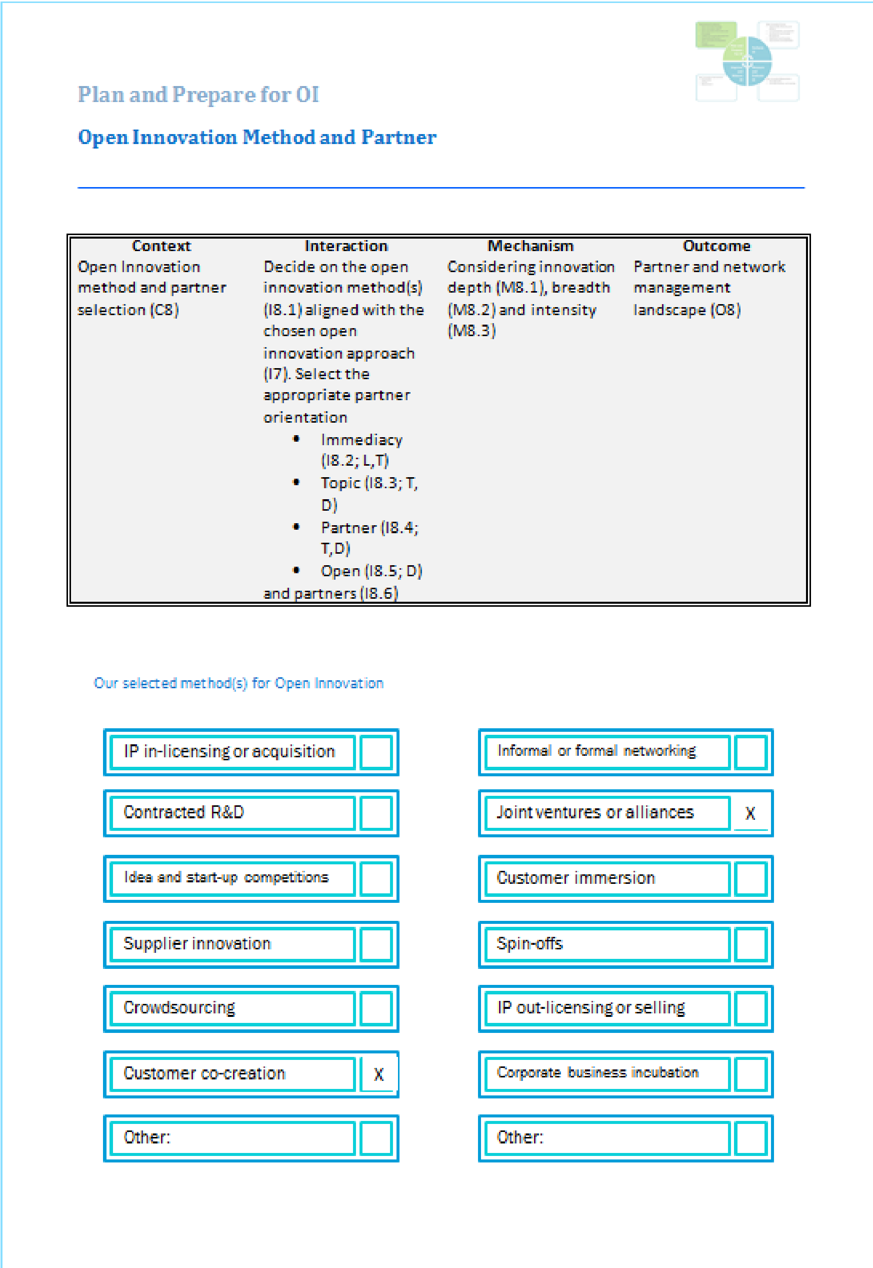


FIGURE 9-2: CASE 1 – OPEN INNOVATION APPROACH

Heat Sense Technologies is considering customer co-creation and joint venture alliances as two open innovation methods to pursue. This will help them tap into the requirements from their customers and overcome their challenge with the development skills set that they need.



Plan and Prepare for OI

Open Innovation Method and Partner

Context	Interaction	Mechanism	Outcome
Open Innovation method and partner selection (C8)	Decide on the open innovation method(s) (I8.1) aligned with the chosen open innovation approach (I7). Select the appropriate partner orientation • Immediacy (I8.2; L,T) • Topic (I8.3; T, D) • Partner (I8.4; T,D) • Open (I8.5; D) and partners (I8.6)	Considering innovation depth (M8.1), breadth (M8.2) and intensity (M8.3)	Partner and network management landscape (O8)

Our selected method(s) for Open Innovation

IP in-licensing or acquisition		Informal or formal networking	
Contracted R&D		Joint ventures or alliances	X
Idea and start-up competitions		Customer immersion	
Supplier innovation		Spin-offs	
Crowdsourcing		IP out-licensing or selling	
Customer co-creation	X	Corporate business incubation	
Other:		Other:	

FIGURE 9-3: CASE 1 – OPEN INNOVATION METHOD AND PARTNER (PAGE 1)

The organisation would prefer to partner with non-competitor organisations and also with customers. They also think that they may require partnering with an intermediary, but they are not sure yet if that will turn out to be required and will reassess that option later in the innovation cycle. Their innovation focus will be Topical orientated, since they have a specific product category in mind within which to innovate.

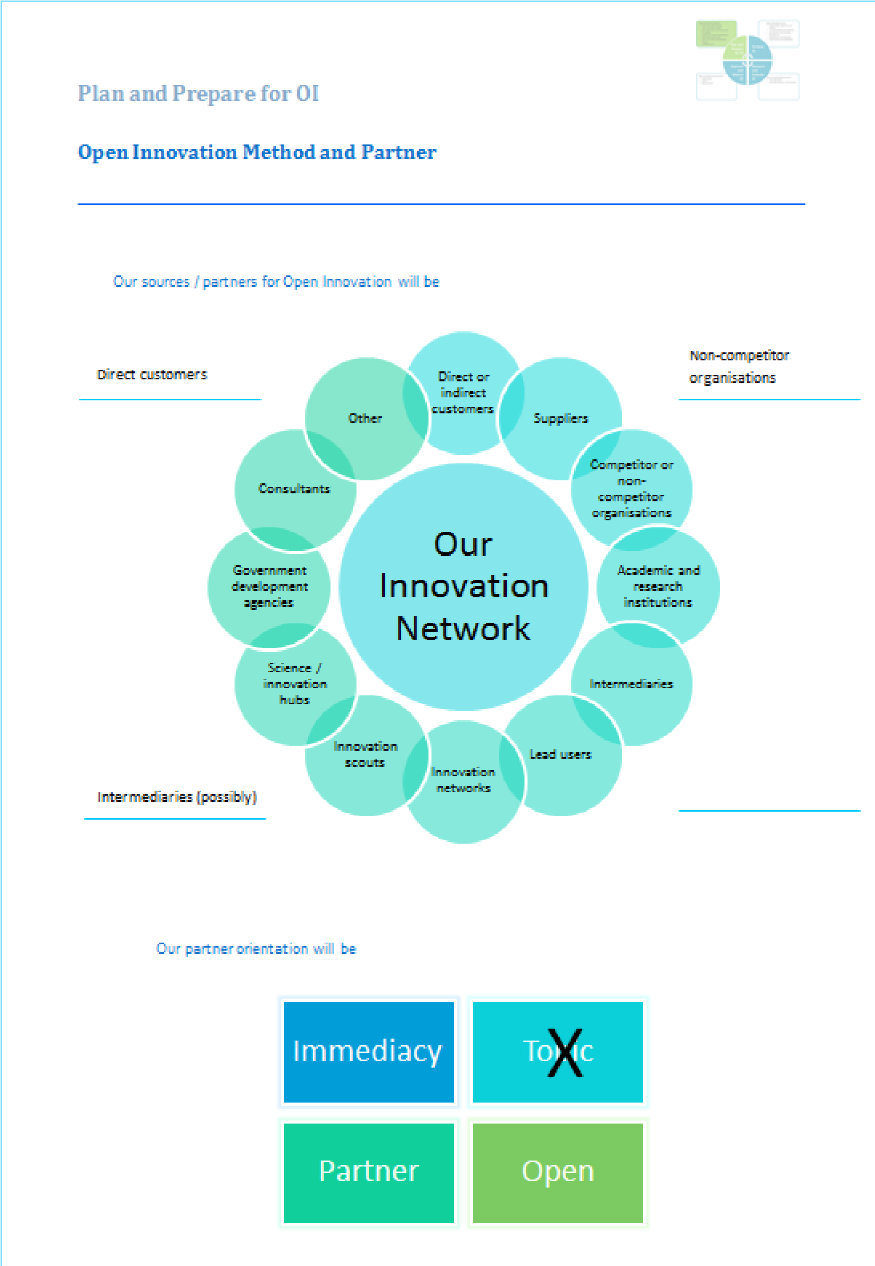


FIGURE 9-4: CASE 1 – OPEN INNOVATION METHOD AND PARTNER (PAGE 2)

There is strong leadership support for open innovation in the organisation. A dedicated budget has been made available for open innovation initiatives and innovation teams also have leadership team representation (which is typical for a small to medium-sized organisation). The organisation hopes to become more open over time, but would prefer to retain some closed innovation practices in the medium term.

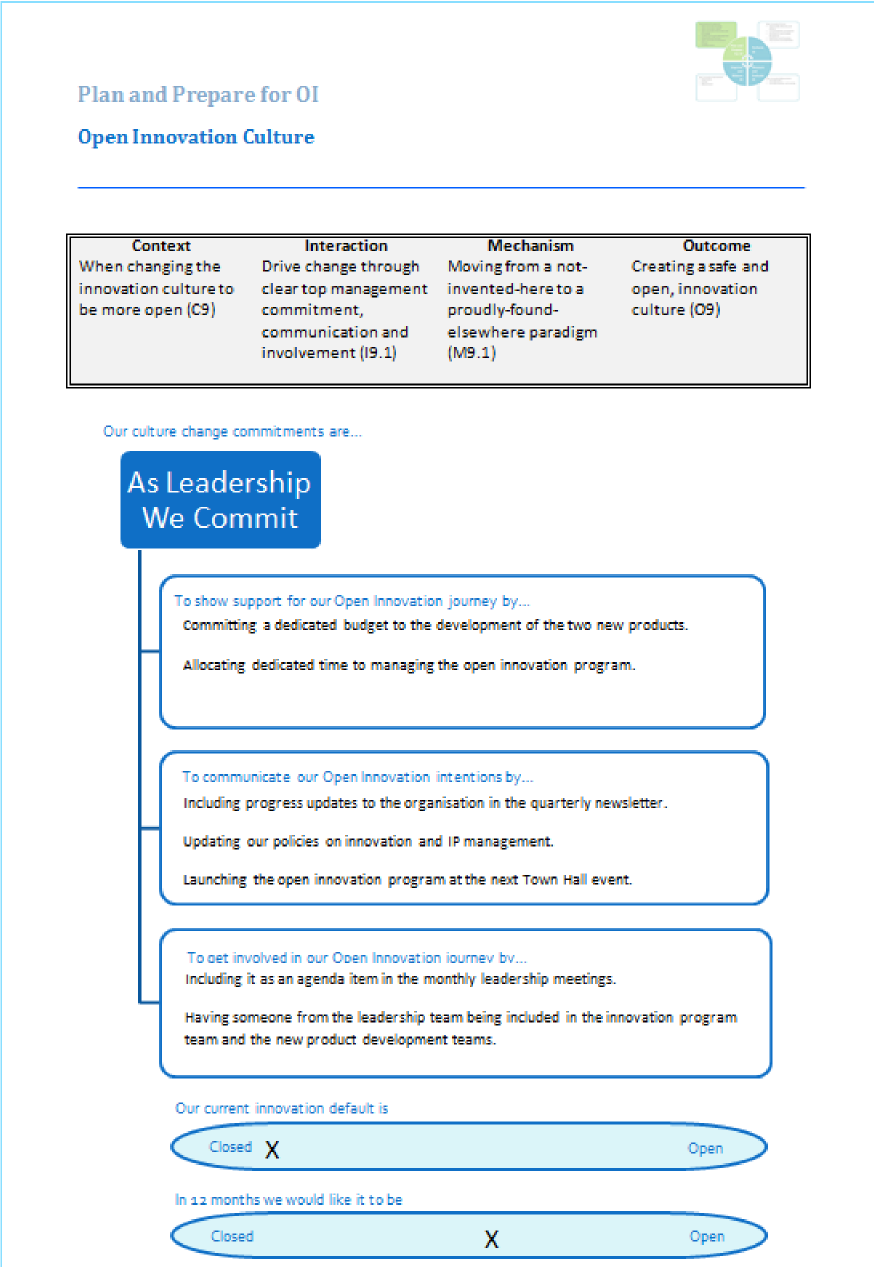


FIGURE 9-5: CASE 1 – OPEN INNOVATION CULTURE

Heat Sense Technologies will have to share information and managed information they receive during the open innovation process. Policies and procedures will have to be updated to reflect how this information will be stored and appropriately managed by employees. Internally, they have selected to make use of SharePoint as a document-management solution, since they already use it for some of their projects and product design storage. Employees will need clear direction on what information they can share at which stage of the innovation process so as not to run into any IP issues later on.

Plan and Prepare for OI

Open Innovation Knowledge

Context	Interaction	Mechanism	Outcome
When managing knowledge during innovation (C10)	Establish formal practices to manage complex and distributed knowledge internal and external to the organisation (I10.1), leveraging technology to simplify this task and to connect to other complimentary organisational platforms (I10.2; T,D)	Through the configuration of knowledge capacities (M10.1) and collaborative technology platforms (M10.2)	For effective knowledge utilisation (O10)

Which critical information will need to be managed?

Information we will receive	Information we will share
Information from partners on their digital capabilities. Ideas from customers on requirements for a new detection device.	Interfaces to our technology Maybe supplier information?

How will we manage our information?

Technology	Policies, Processes, Procedures
Making use of SharePoint to manage our information (documents, designs etc). Secured DropBox access could be considered.	We may have to update our policies on information sharing and customer interaction under the company's name. Possible new policies required for information-sharing with partners and formats/channels used for this.

FIGURE 9-6: CASE 1 – OPEN INNOVATION KNOWLEDGE

The organisation will have to protect their IP during the innovation process. They have patented their current sensor and device technologies, but will have to share that information with their innovation partners. The new devices will also require patents for IP protection, while using non-disclosure agreements and trade secrets to protect some of the 'know-how' of their manufacturing process if that becomes relevant. Any coding done by the partner company will be protected by copyright.

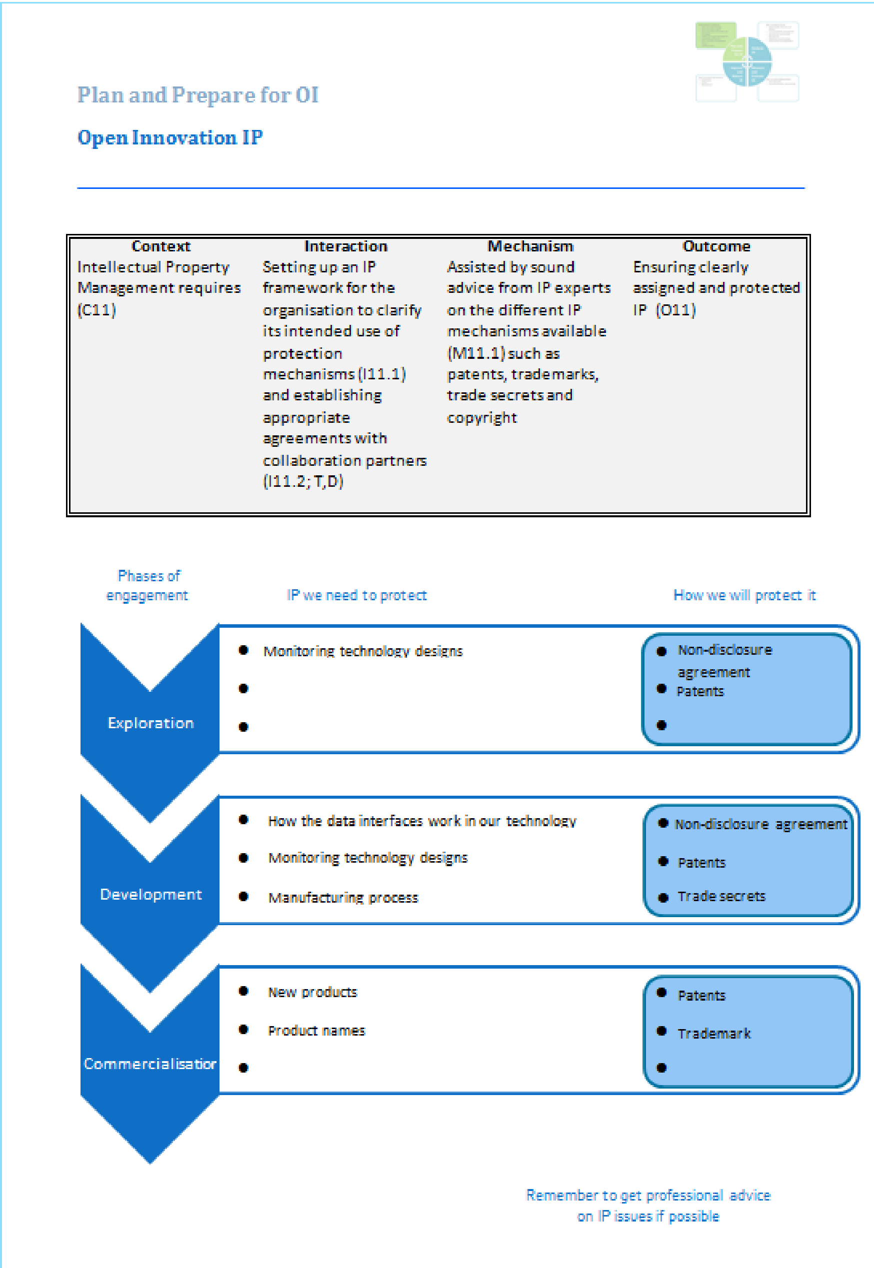


FIGURE 9-7: CASE 1 – OPEN INNOVATION IP

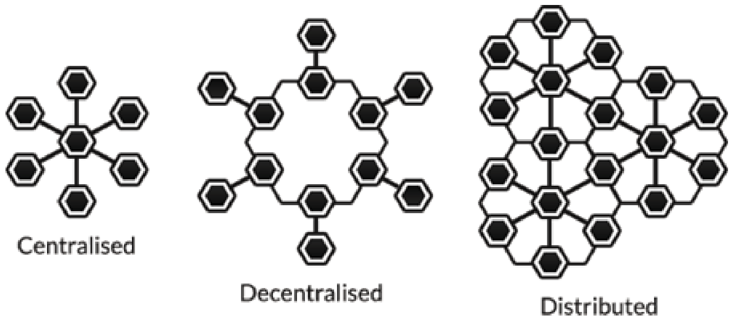
Even though there will be an Open Innovation Lead role assigned, taking ownership of adopting open innovation in the organisation will be a shared responsibility where every employee will have to get involved, because of the number of employees in the organisation. Roles are therefore not dedicated to open innovation only, but become an additional function to perform as part of their current role descriptions.

Plan and Prepare for OI

Open Innovation Org Structure and Networks

Context	Interaction	Mechanism	Outcome
The impact on Organisational Structures and Networks will require (C12)	Assigning new roles (I12.1; L,T,D) and possible new structures (12.2; T,D) supportive of open innovation and establishing and nurturing internal and external innovation networks (I12.3; L,T,D)	Providing responsibilities and mandates to execute open innovation (M12.1) and manage partner/innovator relationships	Resulting in an open organisational structure and innovation network (O12)

Our Open Innovation model (or planned model) can best be represented by



A central team driving Open Innovation	Various teams across the organisation driving Open Innovation	Responsibility is shared among everyone
☐	☐	X

Some challenges we will need to address implementing this model will be

Freeing up time for employees to manage the open innovation relationships over and above BAU

FIGURE 9-8: CASE 1 – OPEN INNOVATION ORGANISATION STRUCTURE AND NETWORKS (PAGE 1)

Internally, an open innovation network will have to be managed between the Development, Manufacturing and the Product and Marketing teams to work together within the open innovation process. External networks will have to be nurtured for customers and the new development partners.

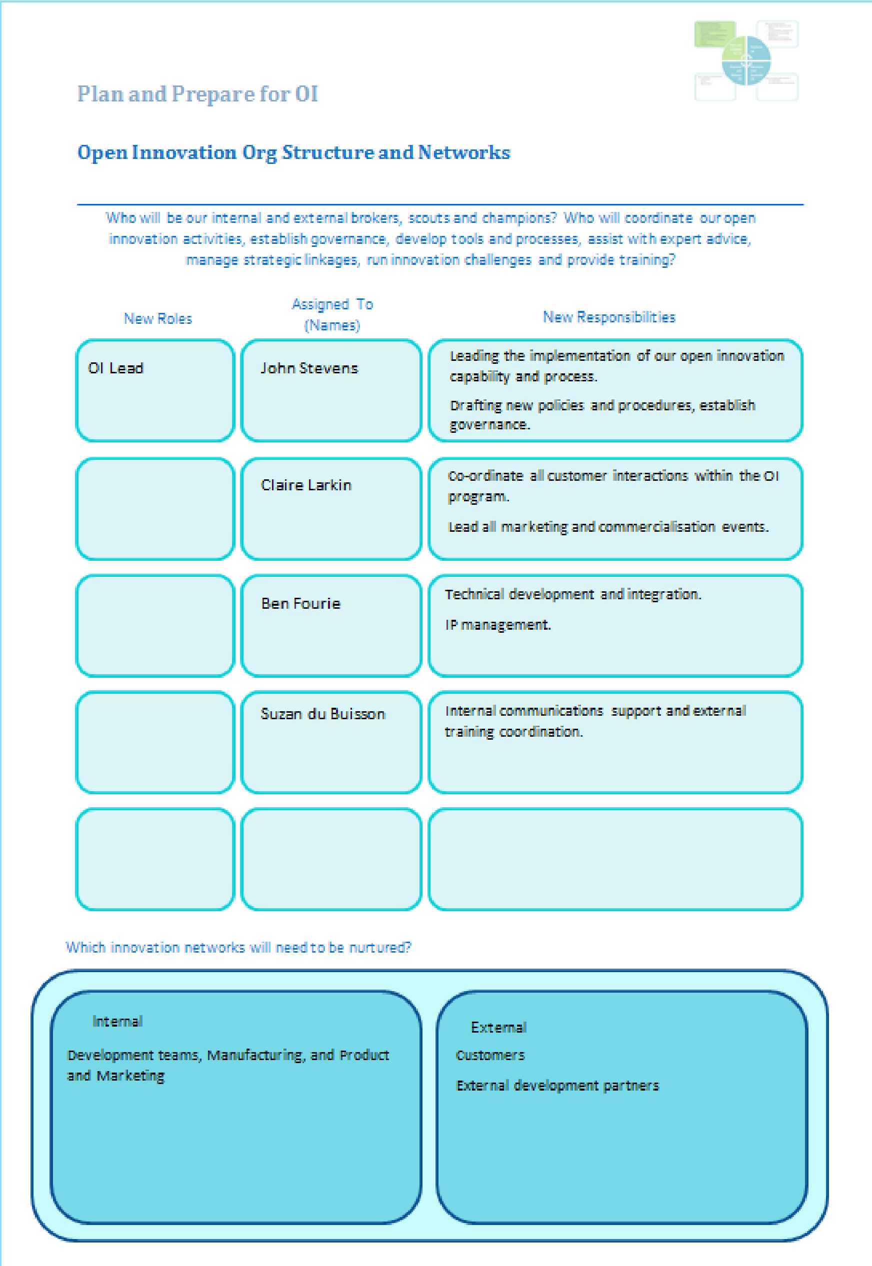


FIGURE 9-9: CASE 1 – OPEN INNOVATION ORGANISATION STRUCTURE AND NETWORKS (PAGE 2)

The organisation has previously done some open innovation activities, but they will be required to increase their knowledge and skills to manage a partnership (co-development) for the product development that they are planning. Commercial management will be more challenging than what they are used to and managing this new partnership will also add additional stress on their resource capacity.

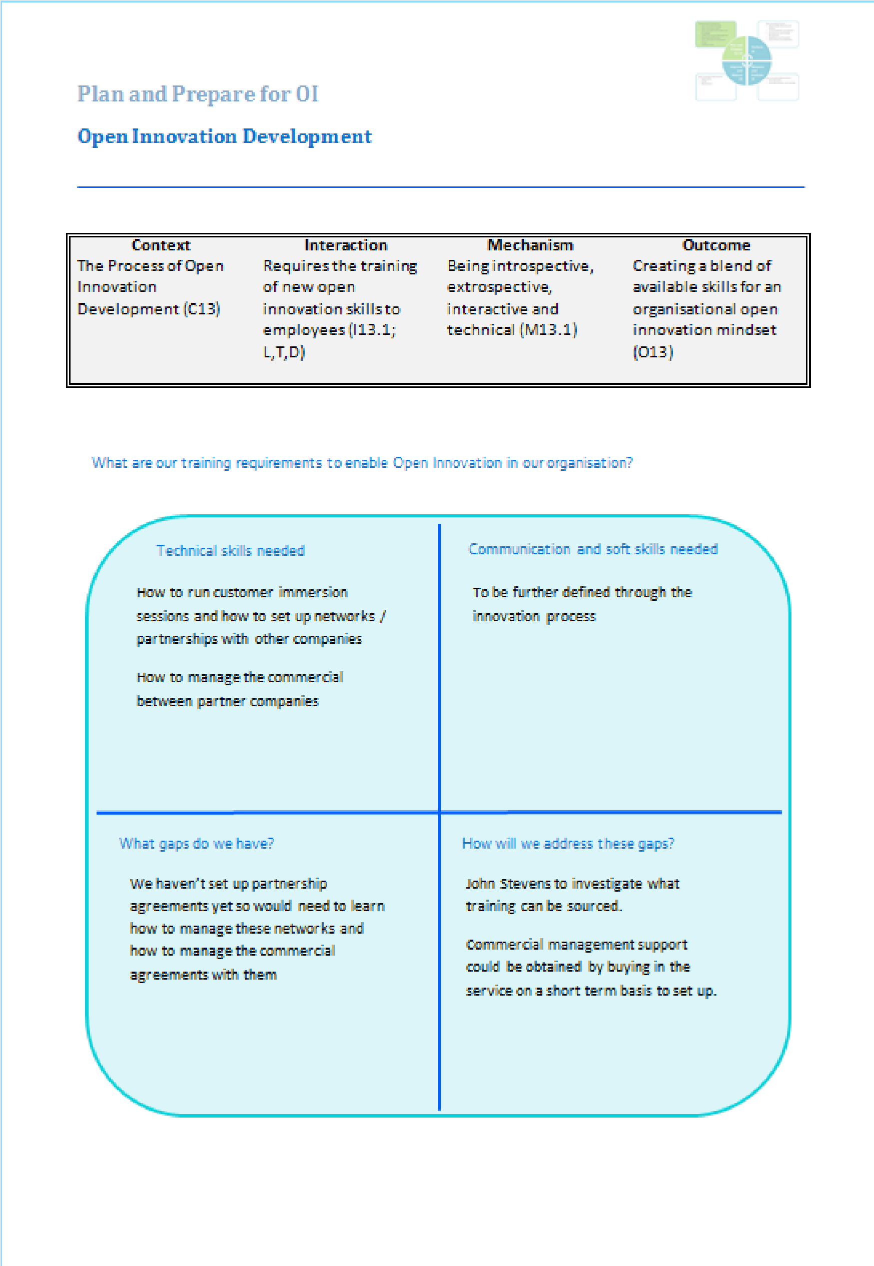


FIGURE 9-10: CASE 1 – OPEN INNOVATION DEVELOPMENT

As a final checklist, Heat Sense Technologies is confident that they have considered all the preparation questions and done all the needed activities to now move ahead and start their open innovation process.

Plan and Prepare for OI

Open Innovation Enabling Factors

Context	Interaction	Mechanism	Outcome
Open Innovation Enablement requires Enabling Factors (C14)	Such as the implementation of clear policies (I14.1), managing change (I14.2) and a final readiness assessment (I14.3)	Strengthening governance (M14.1) and leveraging industry change frameworks (M14.2) and readiness checklists (M14.3)	For an enabling environment to execute Open Innovation (O14)

Have we considered everything in our checklist below?

	For Proposers...	For Seekers...	Considered?
DEFINITION	Can you define what you offer to external partners on your own? Or is the knowledge you wish to share more of the sort where your new partners have to share their needs first before relating to them?	Can you define the idea/knowledge you are looking for? Is it something specific related to a well-defined problem? Or are you looking for a surprise instead?	Yes
VISIBILITY	Do you know your strengths? Do others know your strengths? Enough to make them consider you a partner? Are you visible enough for external partners?	Do you know where to look for possible new ideas? Are you able to motivate external thinkers to visit you and share their ideas? Or do you have to hunt for the new external ideas on your own?	Yes
COMMON BENEFIT	Have you any idea how to come to a win-win agreement with your partner candidates? What would you offer for your future partners? What is going to be your benefit?		Yes
PROTECTION	Do you have the measures to protect the rights and interests of both parties while coming to this agreement? Did you consider intellectual property issues thoroughly? Are there certain things you should avoid sharing?		Yes
METHODOLOGY	Who is going to be responsible for keeping the established cooperation alive? Can you work together continuously with external partners on a solution? Are your employees accepting external ideas to use them as their own? Who is covering the costs of the collaboration (being available, etc.)?		Yes
STRATEGY	Have you defined what you want to achieve through Open Innovation? Has it been clearly communicated to the organisation? Do you understand your chosen method of engagement and where you want to open up your innovation efforts?		Yes
OIL FRAMEWORK	Have you reviewed all the sections of the OIL Framework under Enabling Open Innovation? Do you have dedicated resources for the implementation, execution and improvement of Open Innovation?		Yes

Are we ready to proceed? X Yes No

Adapted from OPINET – OPEN INNOVATION BEST PRACTICE GUIDE

FIGURE 9-11: CASE 1 – OPEN INNOVATION ENABLING FACTORS

The organisation has defined their open innovation objectives into a project charter, being clear on what the problem is that they are trying to solve and where they need help to innovate. They know that they want to remain in the field of heat- and smoke-detecting devices, but want to modernise it to be more 'Internet of Things'- (IoT) enabled and digitally supported.

Perform OI

Open Innovation Opportunity Discovery and Ideation

Context	Interaction	Mechanism	Outcome
When performing Opportunity Discovery and Ideation (C15)	Define the needs that will be addressed by the ideas to be sourced (I15.1; L,T,D), select the ideation partners to work with and methods to obtain ideas (I15.2;L,T,D), and run idea campaigns (I15.3;L,T,D)	Using appropriate platforms to capture ideas (M15.1) and incentives to increase participation (M15.2)	Resulting in a pipeline of new innovation ideas and opportunities (O15)

What is the unmet need we are trying to solve?

Making smoke and heat detecting devices "smarter", to integrate to more dynamic monitoring methods such as centralised dashboards (corporate clients) or mobile phones (residential clients).

Whose unmet need is this?

Corporate clients (offices, factories, etc) or residential clients which is a new market we would like to enter.

Why is it important to meet this unmet need?

Clients are getting used to digital integration of their devices. New advancements in the Internet of Things (IoT) concepts is creating new expectations from clients to use digital technology to make tasks more integrated and efficient (manual testing vs digital monitoring for instance).

Why has this need not been satisfied before / by someone else?

New opportunity to explore. Advancement in digital capabilities and reduction in development costs have made this more relevant and feasible only in the last few years.

FIGURE 9-12: CASE 1 – OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 1)

The organisation is clear that they require external help with digital development and integration and have decided to follow a directed search to an open network, although consideration is also given to the option of doing a directed search within their supplier network first to see if they can find the capabilities they need. Given the resource burden to perform the search, making use of an intermediary is also a possible option being considered.

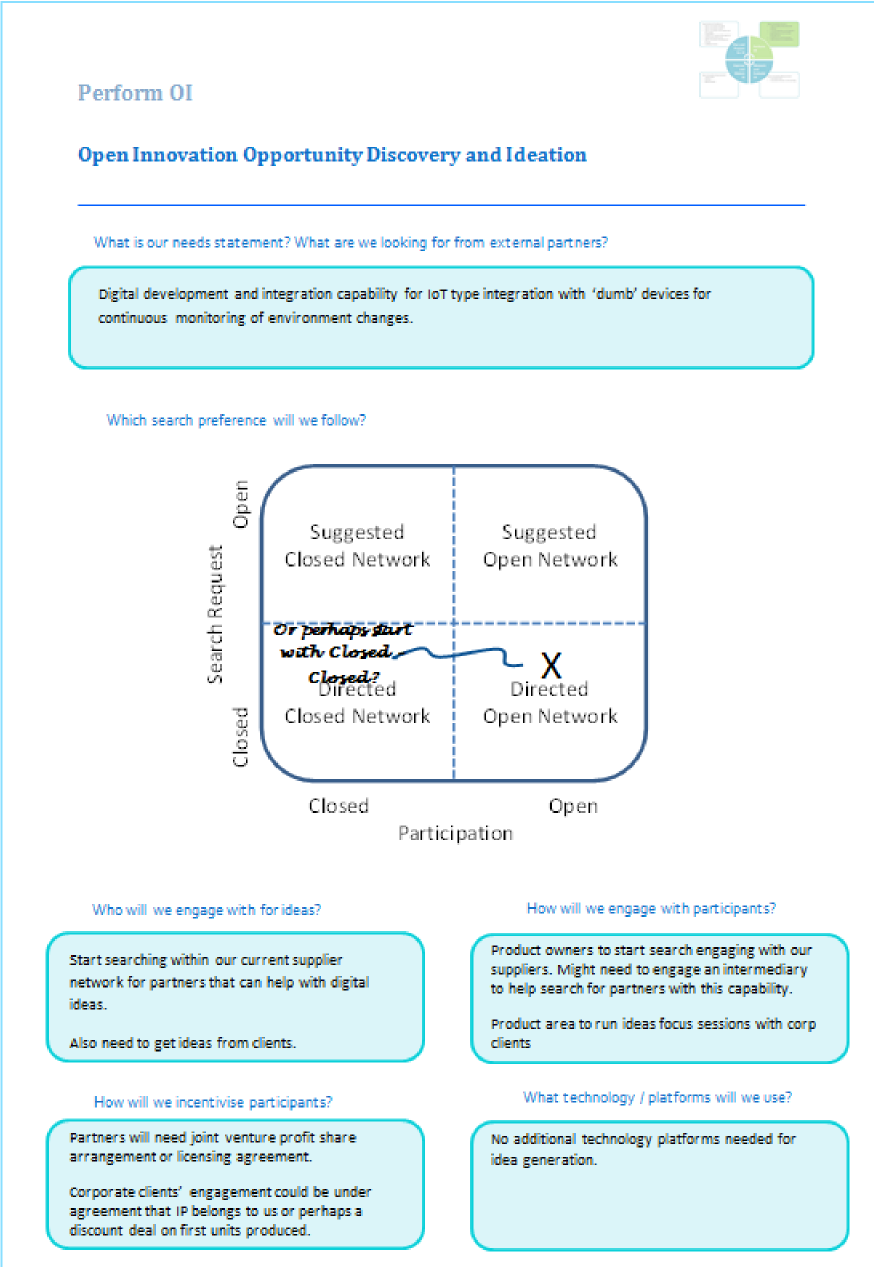
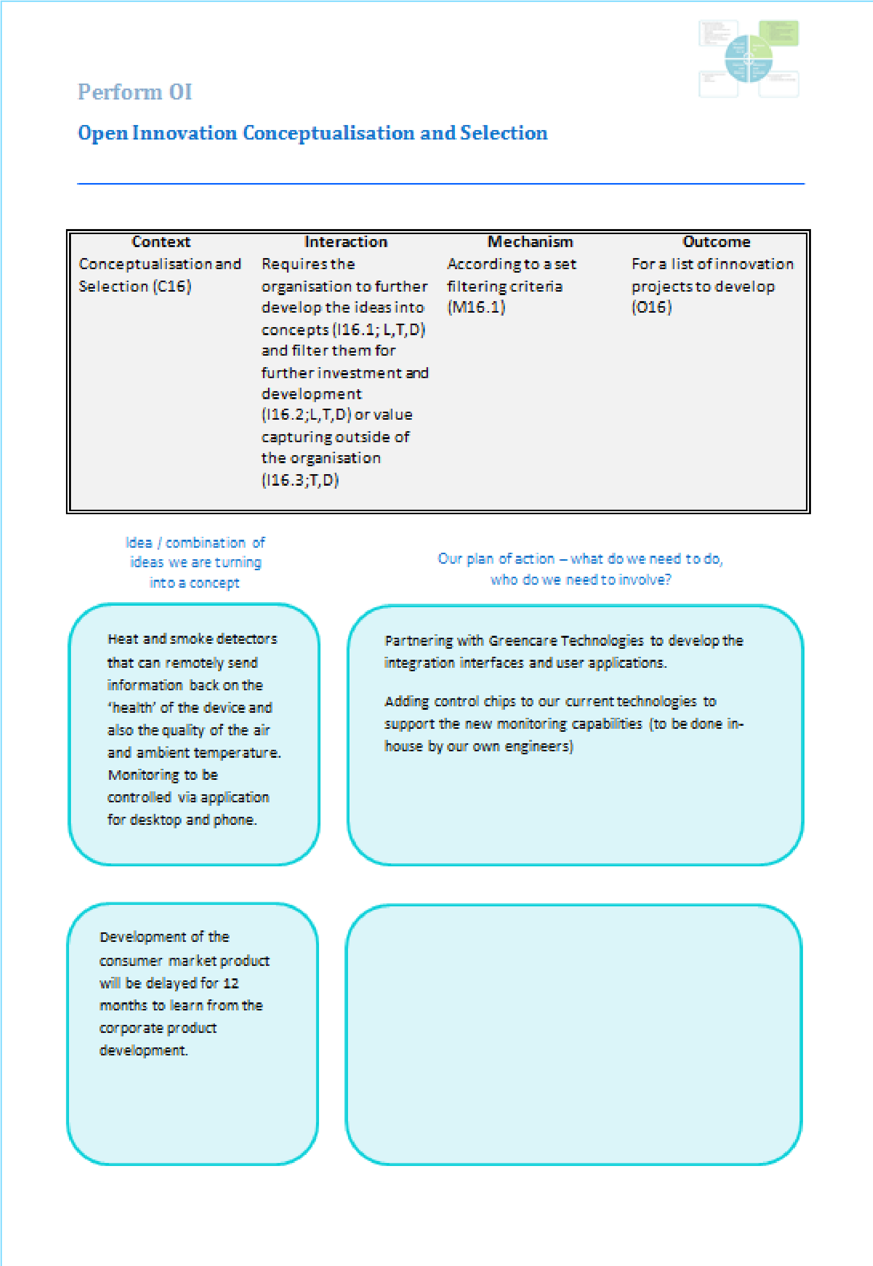


FIGURE 9-13: CASE 1 – OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 2)

The organisation decided to combine the ideas of remote 'health' monitoring, dashboard management and continuous temperature measurement into a single product. A company was chosen to partner with that could provide software development capabilities during the innovation project. Development of the second product was postponed so that its development could later be fast-tracked based on the corporate product.



Perform OI

Open Innovation Conceptualisation and Selection

Context	Interaction	Mechanism	Outcome
Conceptualisation and Selection (C16)	Requires the organisation to further develop the ideas into concepts (I16.1; L,T,D) and filter them for further investment and development (I16.2;L,T,D) or value capturing outside of the organisation (I16.3;T,D)	According to a set filtering criteria (M16.1)	For a list of innovation projects to develop (O16)

Idea / combination of ideas we are turning into a concept

Our plan of action – what do we need to do, who do we need to involve?

Heat and smoke detectors that can remotely send information back on the 'health' of the device and also the quality of the air and ambient temperature. Monitoring to be controlled via application for desktop and phone.

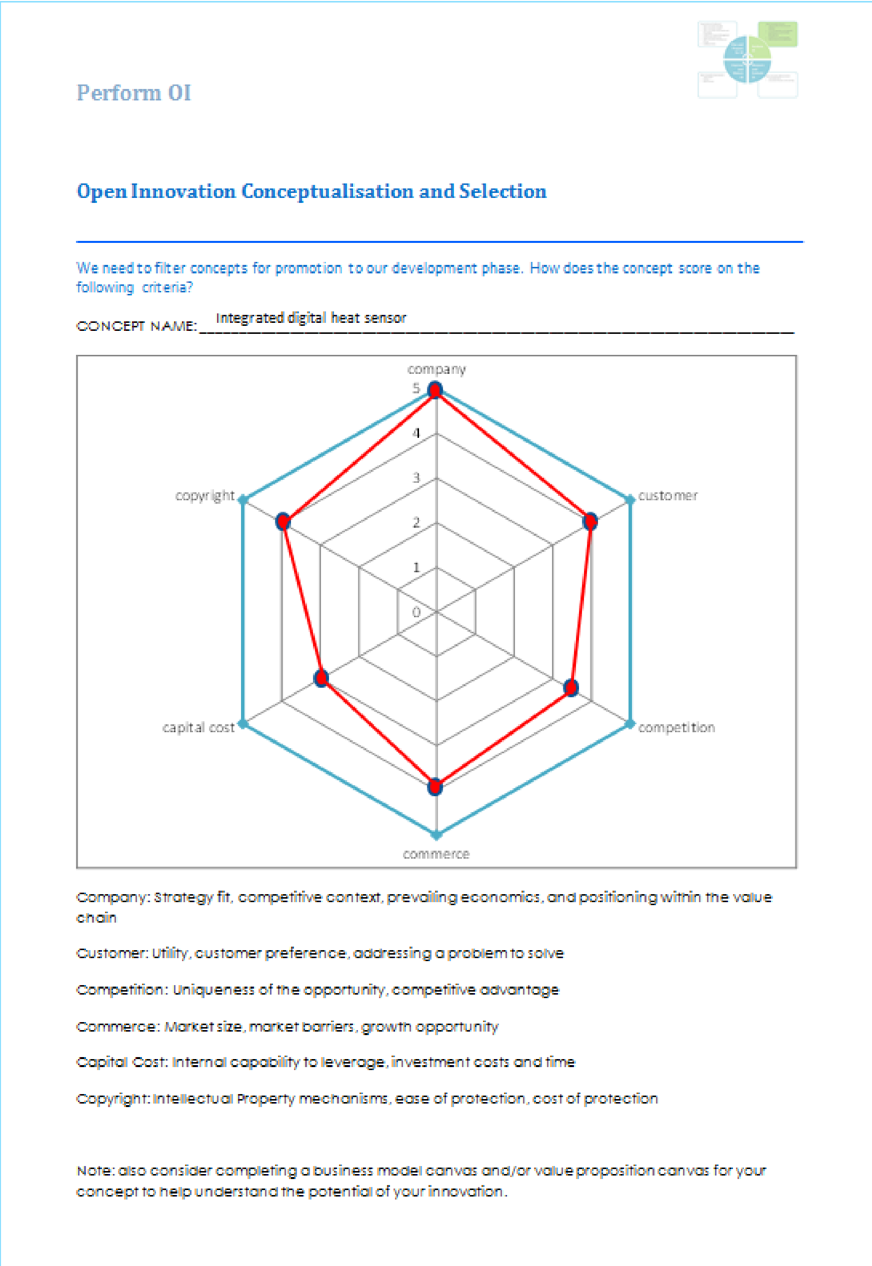
Partnering with Greencare Technologies to develop the integration interfaces and user applications.

Adding control chips to our current technologies to support the new monitoring capabilities (to be done in-house by our own engineers)

Development of the consumer market product will be delayed for 12 months to learn from the corporate product development.

FIGURE 9-14: CASE 1 – OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 1)

Only one concept was selected for further development, so there was no need to make a trade-off decision in this instance. The concept was still mapped according to criteria to make sure that the product will be a good investment to pursue through to commercialisation.


Perform OI

Open Innovation Conceptualisation and Selection

We need to filter concepts for promotion to our development phase. How does the concept score on the following criteria?

CONCEPT NAME: Integrated digital heat sensor

Company: Strategy fit, competitive context, prevailing economics, and positioning within the value chain

Customer: Utility, customer preference, addressing a problem to solve

Competition: Uniqueness of the opportunity, competitive advantage

Commerce: Market size, market barriers, growth opportunity

Capital Cost: Internal capability to leverage, investment costs and time

Copyright: Intellectual Property mechanisms, ease of protection, cost of protection

Note: also consider completing a business model canvas and/or value proposition canvas for your concept to help understand the potential of your innovation.

FIGURE 9-15: CASE 1 – OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 2)

The organisation is considering the product to have profit potential exceeding R5 million and that it can be developed within the strategically decided 18-month window. It also carries relatively low risk in development since it is a field they are well familiar with and will only have to partner for the digital capability which is new to them and slightly adding risk to the project. The consumer product will have a smaller profit potential and will also be a new market for them. This increases risk, but is still acceptable. They also have another small enhancement project underway for one of their current products to balance out their portfolio.

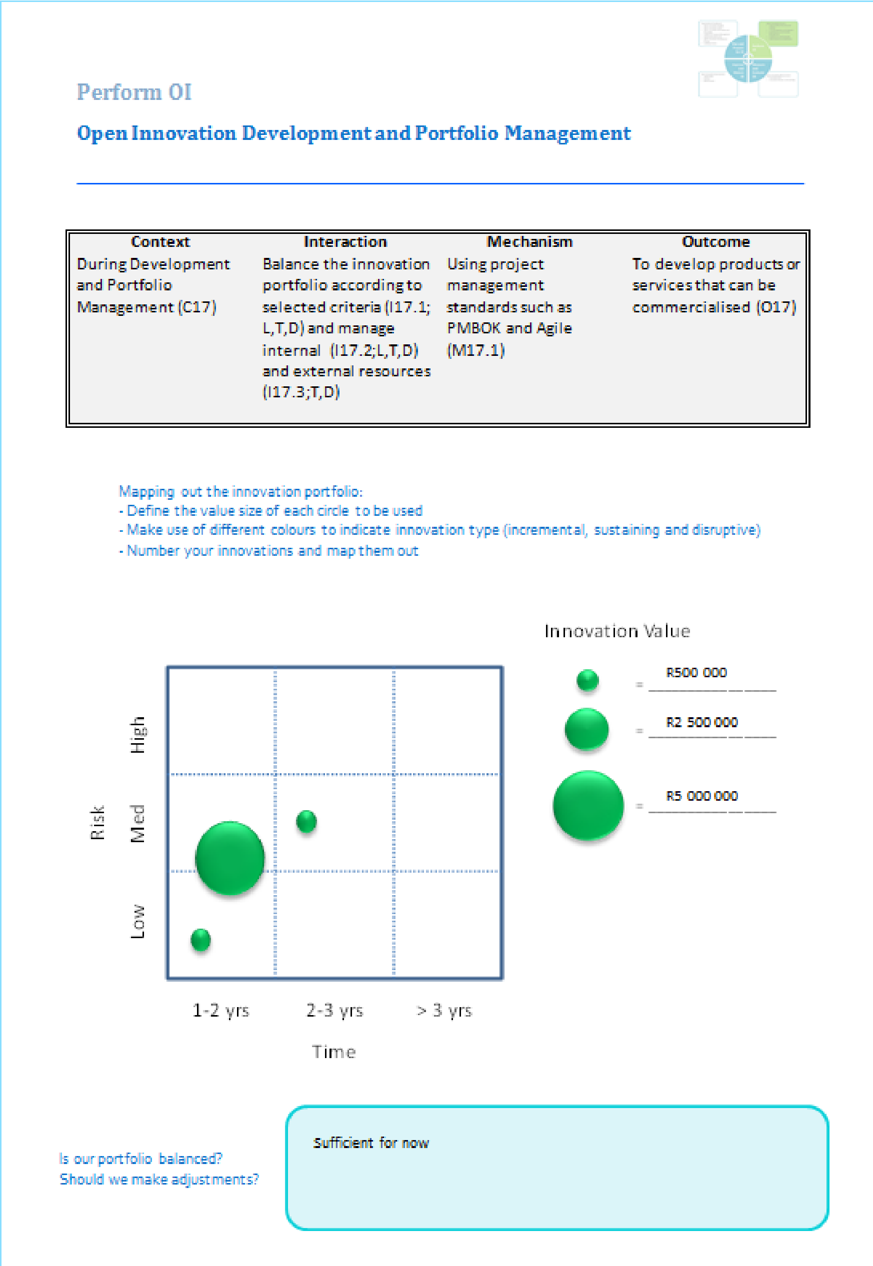
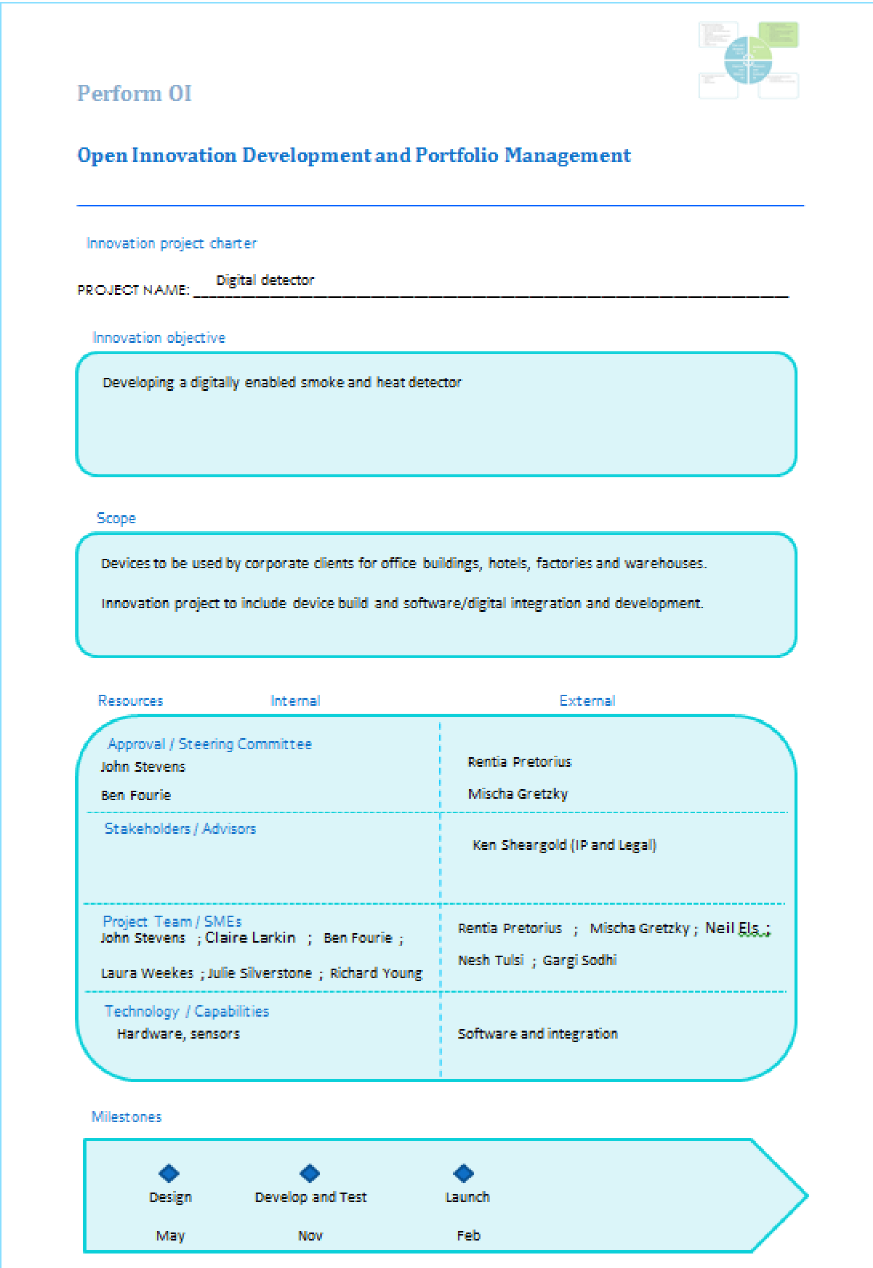


FIGURE 9-16: CASE 1 – OPEN INNOVATION DEVELOPMENT AND PORTFOLIO MANAGEMENT (PAGE 1)

The project charter developed for the project provides a summarised view of the objectives of the project and also defines roles and responsibilities between the organisation and the innovation partner. High-level milestones show expected timelines for development and commercialisation. It is a low-effort project management artefact that helps to provide clarity for the project team and also other employees on the reason and structure of the project.



Perform OI

Open Innovation Development and Portfolio Management

Innovation project charter

PROJECT NAME: Digital detector

Innovation objective

Developing a digitally enabled smoke and heat detector

Scope

Devices to be used by corporate clients for office buildings, hotels, factories and warehouses.

Innovation project to include device build and software/digital integration and development.

Resources	Internal	External
Approval / Steering Committee	John Stevens Ben Fourie	Rentia Pretorius Mischa Gretzky
Stakeholders / Advisors		Ken Sheargold (IP and Legal)
Project Team / SMEs	John Stevens ; Claire Larkin ; Ben Fourie ; Laura Weekes ; Julie Silverstone ; Richard Young	Rentia Pretorius ; Mischa Gretzky ; Neil Els ; Nesh Tulsi ; Gargi Sodhi
Technology / Capabilities	Hardware, sensors	Software and integration

Milestones

Design	Develop and Test	Launch
May	Nov	Feb

FIGURE 9-17: CASE 1 – OPEN INNOVATION DEVELOPMENT AND PORTFOLIO MANAGEMENT (PAGE 2)

After development of the new product, the organisation made sure their plans were in place to market, launch and support the product in the market. It was decided to mainly make use of their current client and installation networks to market the new product. Product support will be split between hardware and software, with Heat Sense Technologies looking after hardware support. Production scalability has been considered and a new patent is being registered to protect the new product.

Perform OI

Open Innovation Deployment and Protection

Context	Interaction	Mechanism	Outcome
To Deploy a new innovation into the market (C18)	The organisation will take sole or joint ownership depending on the innovation strategy adopted (I18.1; L,T,D) and the innovation protected (I18.2;L,T,D)	Through the adoption of deployment practices (M18.1) and IP frameworks (M18.2)	To achieve successful deployment (O18)

For deployment of a new innovation into the market:

What is our marketing and communication plan?

The new product will be marketed to existing clients as an upgrade and to new clients via environment, safety and security installation partners.

Also tradeshow and industry magazine advertising for 3 months.

How have our suppliers and supply chain partners been prepared?

Stock available for 3 months' projected sales. Production can scale up within 2 weeks if demand exceeds projections. Hardware development will be done in-house.

How will we operationally support the new innovation? Sales, operations, customer service, etc.

Software support agreement with Greencare Technologies.

Hardware and direct client support by our own support staff and outsourced technician support.

What are the critical tasks we need to focus on during the first 30 days of launch?

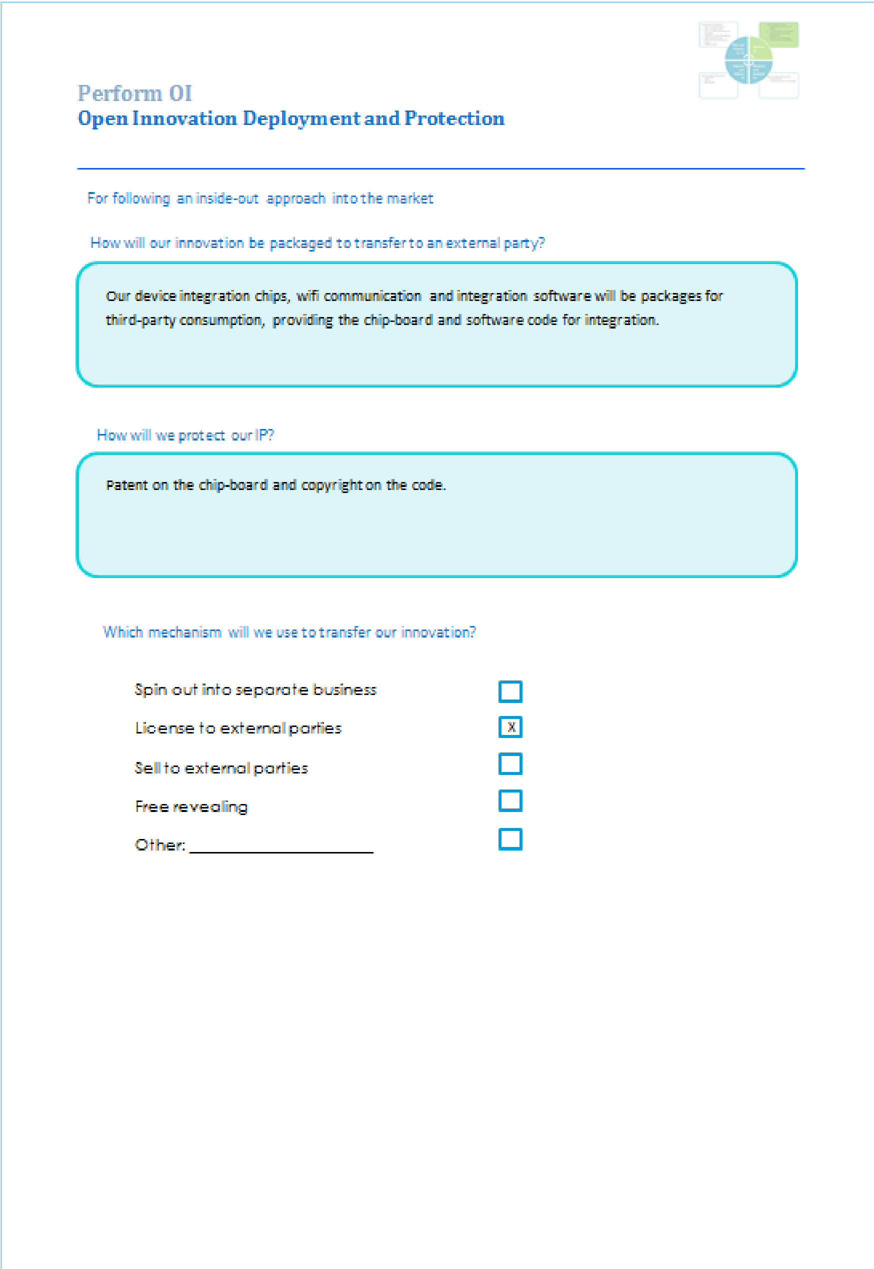
Client support.

Marketing.

How are we protecting our innovation? Patent on new technology being secured

FIGURE 9-18: CASE 1 – OPEN INNOVATION DEPLOYMENT AND PROTECTION (PAGE 1)

Heat Sense Technologies decided to make their communication chips and software applications available for third-party licensing for integration into other IoT devices. This will give them an additional revenue stream and extend their reach into other markets and applications.



Perform OI
Open Innovation Deployment and Protection

For following an inside-out approach into the market

How will our innovation be packaged to transfer to an external party?

Our device integration chips, wifi communication and integration software will be packages for third-party consumption, providing the chip-board and software code for integration.

How will we protect our IP?

Patent on the chip-board and copyright on the code.

Which mechanism will we use to transfer our innovation?

- [ ] Spin out into separate business
- [x] License to external parties
- [ ] Sell to external parties
- [ ] Free revealing
- [ ] Other: ____________________

FIGURE 9-19: CASE 1 – OPEN INNOVATION DEPLOYMENT AND PROTECTION (PAGE 2)

To extract additional value from the product, the organisation will develop their consumer model on the base of the corporate model and will also consider developing other environment-monitoring devices that can be integrated with their software applications for integrated monitoring, management and reporting.

Perform OI

Open Innovation Exploitation and Exploration

Context	Interaction	Mechanism	Outcome
Searching for additional value through Exploitation and Exploration (C19)	Requires the organisation to find opportunities (I19) within current and new customers, markets, channels, knowledge and business models	Considering existing boundaries (M19.1) and new extended boundaries (M19.2)	Resulting in increased appropriated value (O19)

To exploit and explore, consider the following:

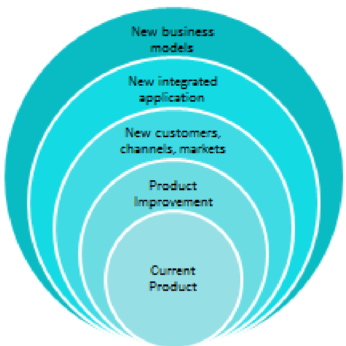
Using your current product (or service) as starting point -

Product Improvement: improve attributes (such as colour, materials, performance or speed) or add new features that customers want (new functionality, premium models, etc.).

New customers, channels, markets: which customers can you target that are currently not using your product? Which additional channels can you use (digital, physical) and what markets can you also move into (lower, premium, international)?

New integrated application: Who else can use your product, either in a different application or in combination with their own to provide an improved value proposition? Can it be sold or licensed?

New business models: Can we develop a new business model around our product or service to better serve customers, appropriate more value and disrupt the market?



Our focus will be:

Leveraging the technology from the corporate model and develop a consumer model.

Consider developing other environment-monitoring devices that can be used with the software applications.

FIGURE 9-20: CASE 1 – OPEN INNOVATION EXPLOITATION AND EXPLORATION

The organisation decided to track only three KPIs, all relating to financial performance, to measure their open innovation success. The KPIs selected would add very little additional effort onto BAU activities so were considered to be sufficient for their business objectives (which was targeted at revenue growth).

Measure and Evaluate OI

Open Innovation KPIs

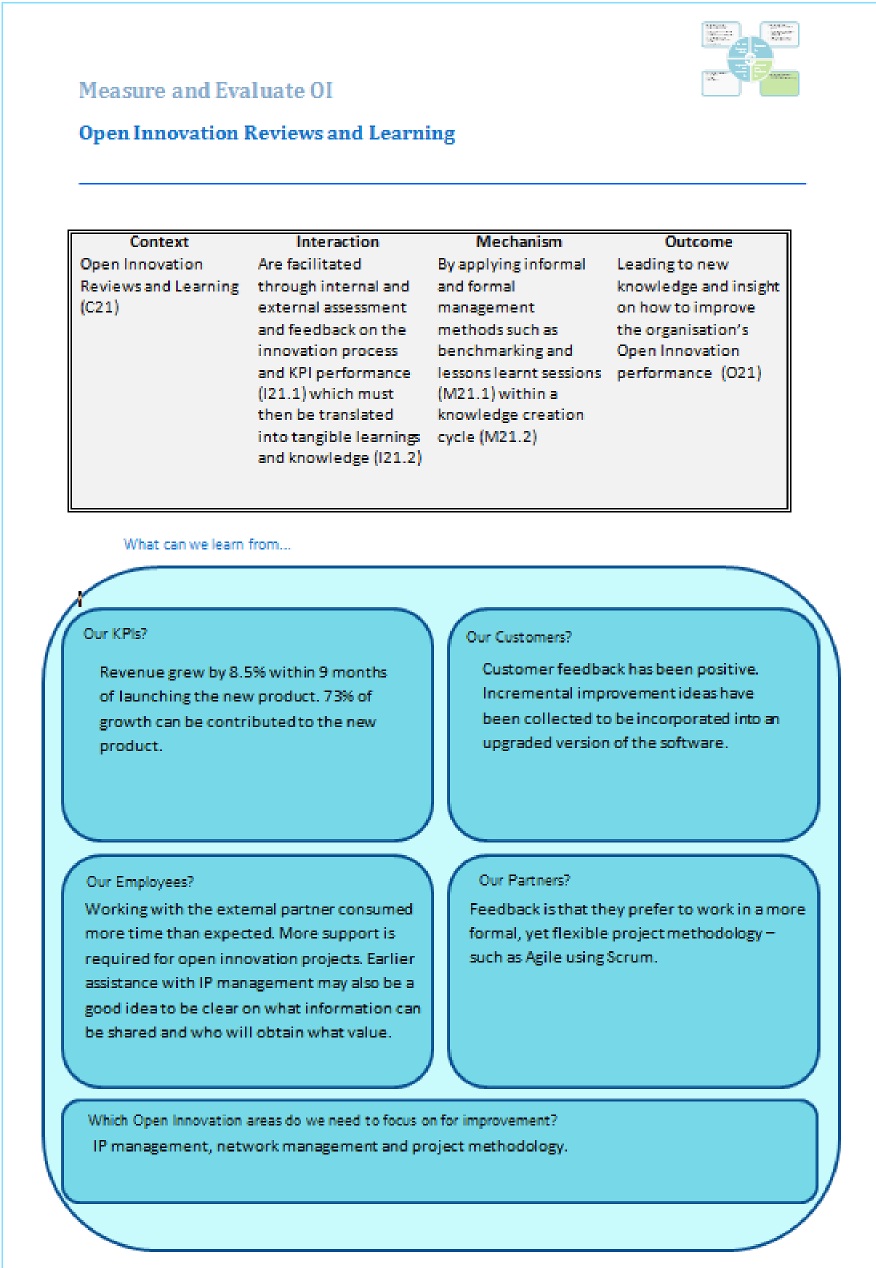
Context	Interaction	Mechanism	Outcome
Innovation KPIs for Open Innovation (C20)	Must be organisation specific, supporting chosen goals and methods (I20.1) and can include financial, input, process, output and outcome KPIs as appropriate (I20.2)	Selected from measurement models and measurement categories (M20.1)	To measure and determine innovation performance (O20)

Our Open Innovation KPIs will include:

KPI		KPI	
Investment in Open Innovation		Number of OI ideas launched	
Percentage of staff trained on OI		OI ideas launched as percentage of all ideas taken to market	
Number of registered users on the OI platform		Number of patents through OI projects	
Number of innovation ideas submitted		Revenue generated through OI projects	x
Percentage of Management trained on OI		Revenue of OI as percentage of total revenue	x
Freedom given by top management to establish search fields outside of the core business		Percentage of OI failures (not launched; not successful)	
Number of unique participants submitting ideas		Revenue generated through IP licensing / sales	x
Percentage of 'usable' ideas compared to total number of ideas submitted		Customer satisfaction of new OI products and services (fit to market)	
Percentage of OI ideas in innovation pipeline vs closed innovation ideas		New market / sales / customers growth through OI products and services	
Number of (active) innovation partners		ROI comparison (OI vs closed innovation)	
Diversity of innovation partners		OI portfolio ratios	
Time to respond to new ideas / solutions		Other:	
Time to market of the innovation		Other:	
Average number of ideas per participant		Other:	
Degree of IP protection (number of ideas protected; number of IP disputes)		Other:	

FIGURE 9-21: CASE 1 – OPEN INNOVATION KPIS

The performance of the product was a great success for the organisation, helping revenue grow by 8.5 percent within 9 months of launch, with strong demand remaining. Internal feedback on the project shows that the IP management process will have to be improved and that resources were challenged to manage the innovation network and deliver on BAU. The development partner was also much more accustomed to using Agile as a project methodology, so training employees on Agile concepts might help with running future projects together.



Context	Interaction	Mechanism	Outcome
Open Innovation Reviews and Learning (C21)	Are facilitated through internal and external assessment and feedback on the innovation process and KPI performance (I21.1) which must then be translated into tangible learnings and knowledge (I21.2)	By applying informal and formal management methods such as benchmarking and lessons learnt sessions (M21.1) within a knowledge creation cycle (M21.2)	Leading to new knowledge and insight on how to improve the organisation's Open Innovation performance (O21)

FIGURE 9-22: CASE 1 – OPEN INNOVATION REVIEWS AND LEARNING

Given the measurement stage feedback, the organisation came up with four possible areas for improvement. However, only three were selected for implementation and adoption and one idea was disregarded after business impact consideration and future demand planning. These improvement options will be implemented in the next cycle of the open innovation approach.

Improve and Mature OI

Open Innovation Improvement

Context	Interaction	Mechanism	Outcome
For Open Innovation Improvement (C22)	Review the outcomes from your Review and Learning exercise (I22.1) and develop improvement options (I22.2) for adoption (I22.3)	Drawing from the best practice notes and previous design propositions in each OIL Framework sub-element (M22.1), additional improvement techniques (M22.2) and adoption selection criteria and management decisions	Improving the organisation's Open Innovation capability and maturity (O22) and Leading into another OIL Framework cycle (O23)

Which improvements will we adopt?

Improvement Option	Benefit	Time	Cost	Other Criteria:	Adopt
Organisation					
Additional team resources	Balance BAU with project	2 months to hire	R450 000		No, next dev will be shorter
IP management consulting	Better IP protection, less rework and Commercial delays	3 weeks per project	R32 000		Yes
Open innovation training to rest of organisation	Awareness of new innovation method. Overcoming 'not invented here syndrome'	3 months	R25 000		Yes
Process					
Agile training	Better engagement with development partner	3 months	R7 500 p.p. (core team only)		Yes
Measurement					
None					

FIGURE 9-23: CASE 1 – OPEN INNOVATION IMPROVEMENT

The illustrative case showed a full end-to-end example of how to apply the open innovation approach within an SME and the type of considerations that will have to be made. This is of course only one example as illustration. SMEs will have a multitude of combinations and scenarios that will be applicable to their own contexts that they will have to consider. In this case the templates provided a reference for the SME when deciding whether to adopt this approach and to get a sense of how the approach would be applied. It also demonstrated the flow and application of the approach elements to verify the usability and applicability from a research methodology perspective.

9.3.2 Partial Real-World Scenario

To further demonstrate the open innovation approach, a partial real-world example is provided below. The templates were completed by one of the SMEs involved in the validation survey from section 6 of this chapter. Not all the templates in the approach were completed, since this would have required at least one full iteration of the open innovation life cycle. It therefore covers only the first 12 templates up to Conceptualisation and Selection, which the SME felt could be done within the time available for the study. Some template sections have been left blank by the owner during this exercise. This can be expected in a real-world example where the user has the option to complete the templates as they see fit to meet their own objectives and where some sections may not apply to their situation.

The organisation provides martial arts training for self-defence and fitness. The organisation classified itself as 'Limited' on the maturity assessment.

The organisation's main business focus is increased growth, but wants this to happen in close relationship with its customers/students. It will focus on incremental innovation and has a low appetite for risk due to its size and investment profile.

Plan and Prepare for OI

Open Innovation Strategy

Context	Interaction	Mechanism	Outcome
When developing an Open Innovation Strategy (C6)	Decide on innovation goals aligned to business strategy (I6.1; L,T,D) and obtain an innovation portfolio view (I6.2; T,D)	Managing investment and risk (M6)	Providing a view of 'what' innovation will be developed (O6)

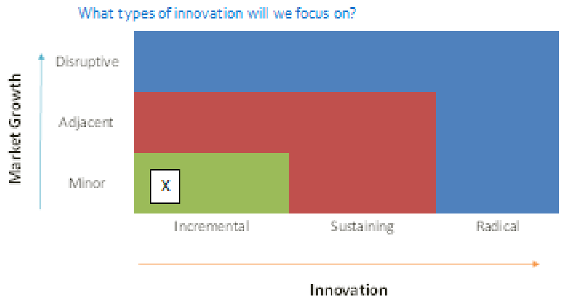


FIGURE 9-24: CASE 2 – OPEN INNOVATION STRATEGY

The organisation selected an inbound approach with the aim of increasing ideas for innovation.

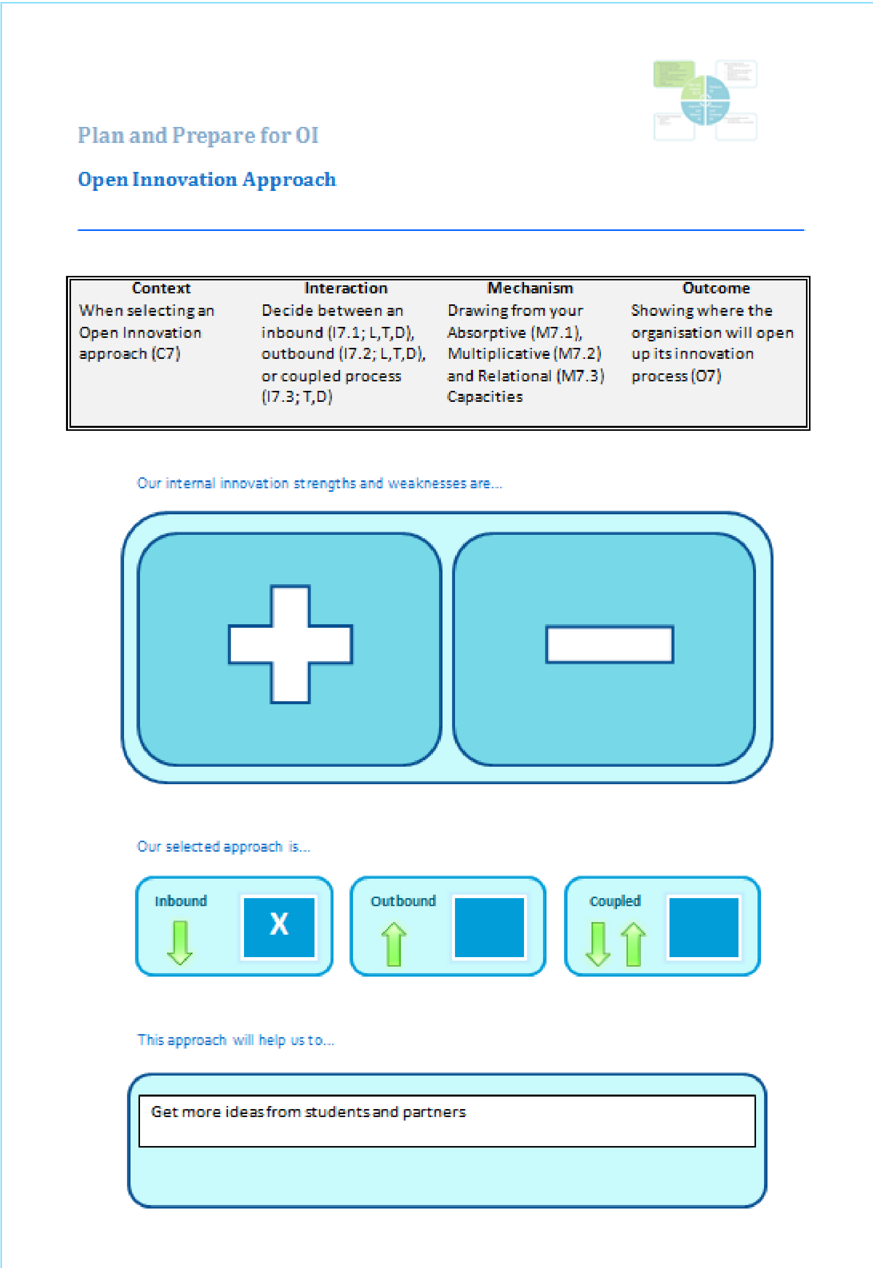


FIGURE 9-25: CASE 2 – OPEN INNOVATION APPROACH

The selected innovation methods were working with supplier and industry bodies, co-creating with customers, informal networking and customer immersion to understand customer needs.

Plan and Prepare for OI

Open Innovation Method and Partner

Context	Interaction	Mechanism	Outcome
Open Innovation method and partner selection (C8)	Decide on the open innovation method(s) (I8.1) aligned with the chosen open innovation approach (I7). Select the appropriate partner orientation • Immediacy (I8.2; L,T) • Topic (I8.3; T, D) • Partner (I8.4; T,D) • Open (I8.5; D) and partners (I8.6)	Considering innovation depth (M8.1), breadth (M8.2) and intensity (M8.3)	Partner and network management landscape (O8)

Our selected method(s) for Open Innovation

IP in-licensing or acquisition	✓ Informal or formal networking
Contracted R&D	Joint ventures or alliances
Idea and start-up competitions	✓ Customer immersion
✓ Supplier innovation	Spin-offs
Crowdsourcing	IP out-licensing or selling
✓ Customer co-creation	Corporate business incubation
Other:	Other:

FIGURE 9-26: CASE 2 – OPEN INNOVATION METHOD AND PARTNER (PAGE 1)

Innovation partners selected were customers, suppliers and institutions. The partner orientation is Immediacy, since these relationships already exist and would be easier to manage and maintain.

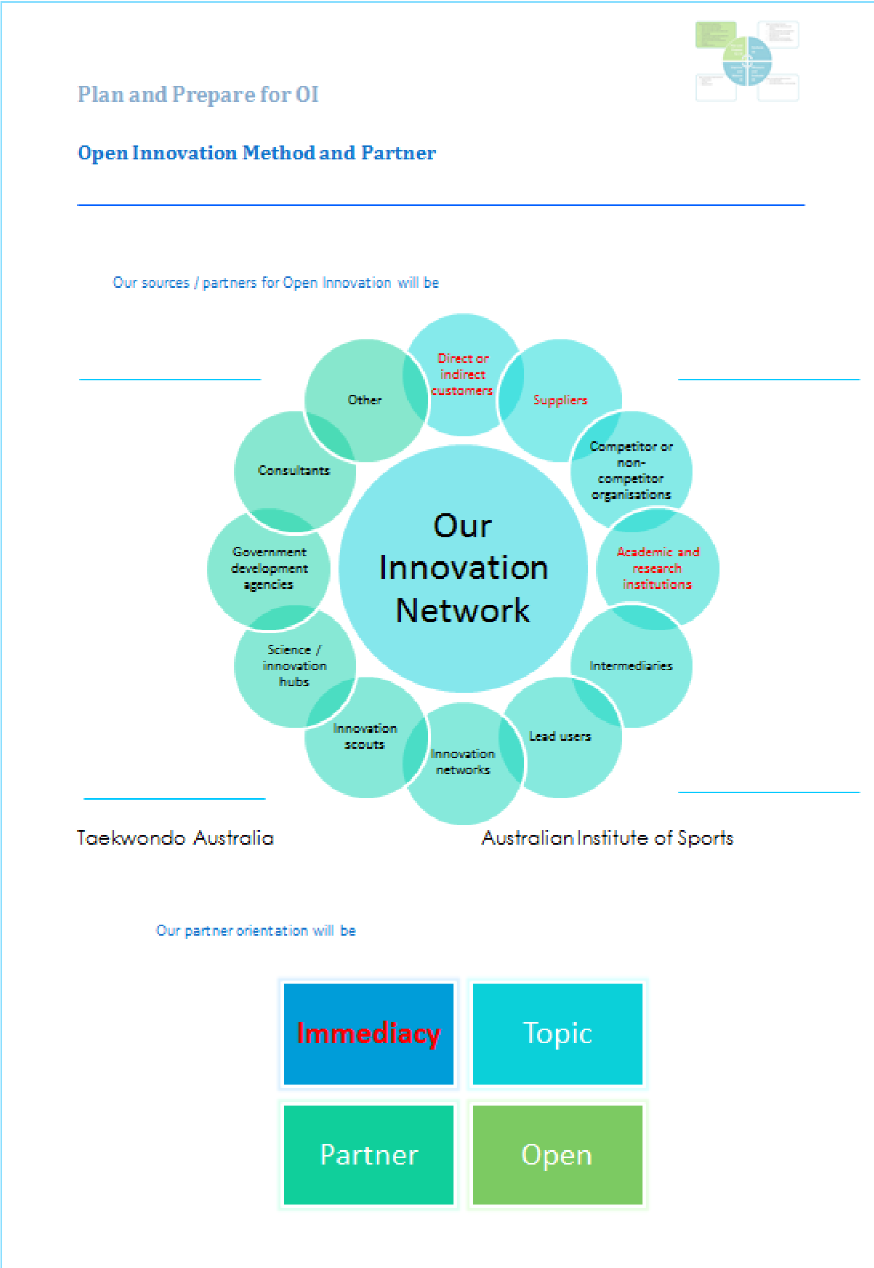


FIGURE 9-27: CASE 2 – OPEN INNOVATION METHOD AND PARTNER (PAGE 2)

iTaekwondo stated succinct, but clear commitments to support its open innovation culture.

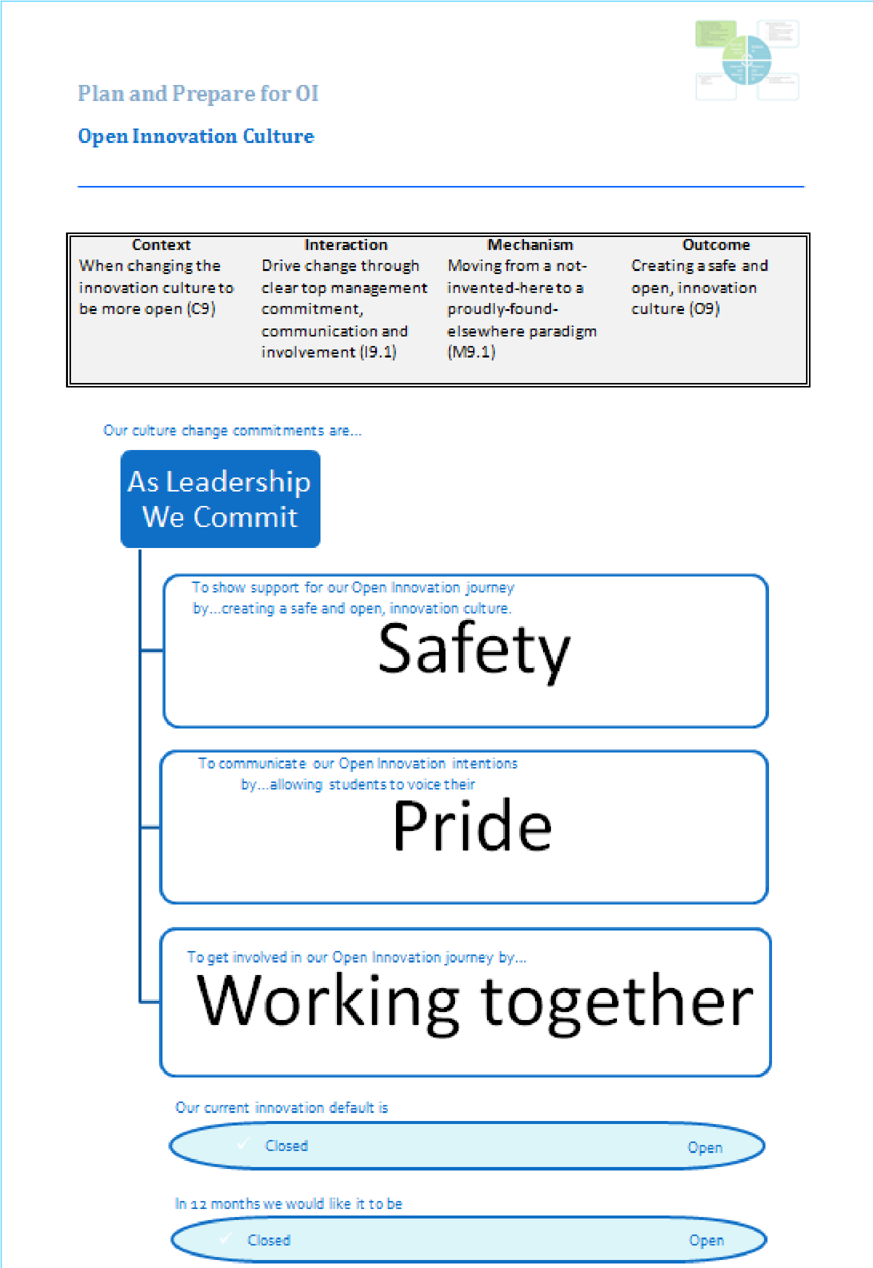


FIGURE 9-28: CASE 2 – OPEN INNOVATION CULTURE

The information management requirements were not excessive.

Plan and Prepare for OI

Open Innovation Knowledge

Context	Interaction	Mechanism	Outcome
When managing knowledge during innovation (C10)	Establish formal practices to manage complex and distributed knowledge internal and external to the organisation (I10.1), leveraging technology to simplify this task and to connect to other complimentary organisational platforms (I10.2; T,D)	Through the configuration of knowledge capacities (M10.1) and collaborative technology platforms (M10.2)	For effective knowledge utilisation (O10)

Which critical information will need to be managed?

Information we will receive:	Information we will share with Sporting bodies such as Taekwondo Australia (Ta) and Australian Institute of Sports (AIS):
Student Name Student DoB Student Address Student Mobile Student Accreditation/Level Student Achievements Student Payments	Student Name Student DoB Student Accreditation/Level

How will we manage our information?

Technology	Policies, Processes, Procedures
Use Taekwondo Australia website to manage information	Leverage Taekwondo Australia Policies, Processes and Procedures Collaborate with industry peers

FIGURE 9-29: CASE 2 – OPEN INNOVATION KNOWLEDGE

No IP management strategies or mechanisms were defined. The owner did not see any IP protection requirements resulting from the initiative at this stage.

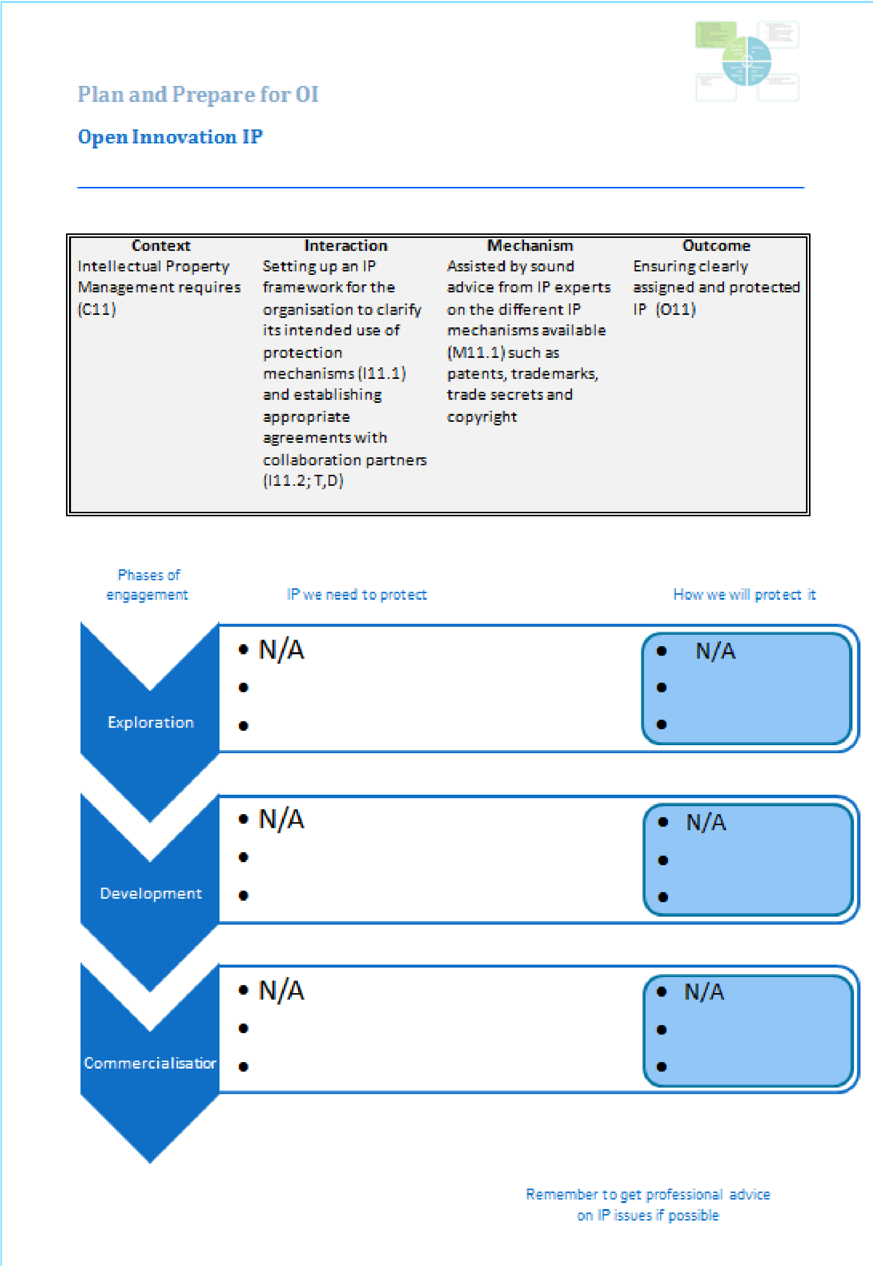


FIGURE 9-30: CASE 2 – OPEN INNOVATION IP

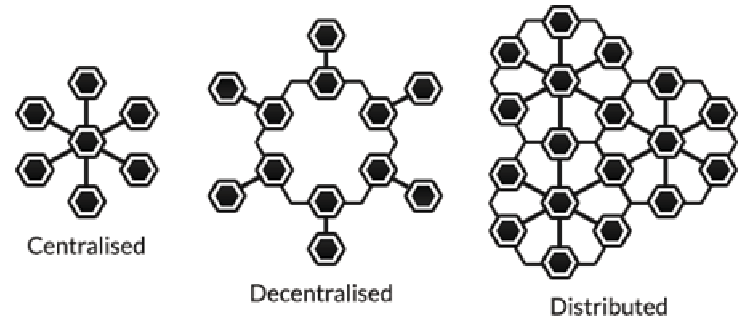
A centralised model will be followed since this is a very small organisation.

Plan and Prepare for OI

Open Innovation Org Structure and Networks

Context	Interaction	Mechanism	Outcome
The impact on Organisational Structures and Networks will require (C12)	Assigning new roles (I12.1; L,T,D) and possible new structures (12.2; T,D) supportive of open innovation and establishing and nurturing internal and external innovation networks (I12.3; L,T,D)	Providing responsibilities and mandates to execute open innovation (M12.1) and manage partner/innovator relationships	Resulting in an open organisational structure and innovation network (O12)

Our Open Innovation model (or planned model) can best be represented by



A central team driving Open Innovation	Various teams across the organisation driving Open Innovation	Responsibility is shared among everyone
✓		

Some challenges we will need to address implementing this model will be

FIGURE 9-31: CASE 2 – OPEN INNOVATION ORGANISATION STRUCTURE AND NETWORKS (PAGE 1)

Specific responsibilities were assigned to the employees.[6]

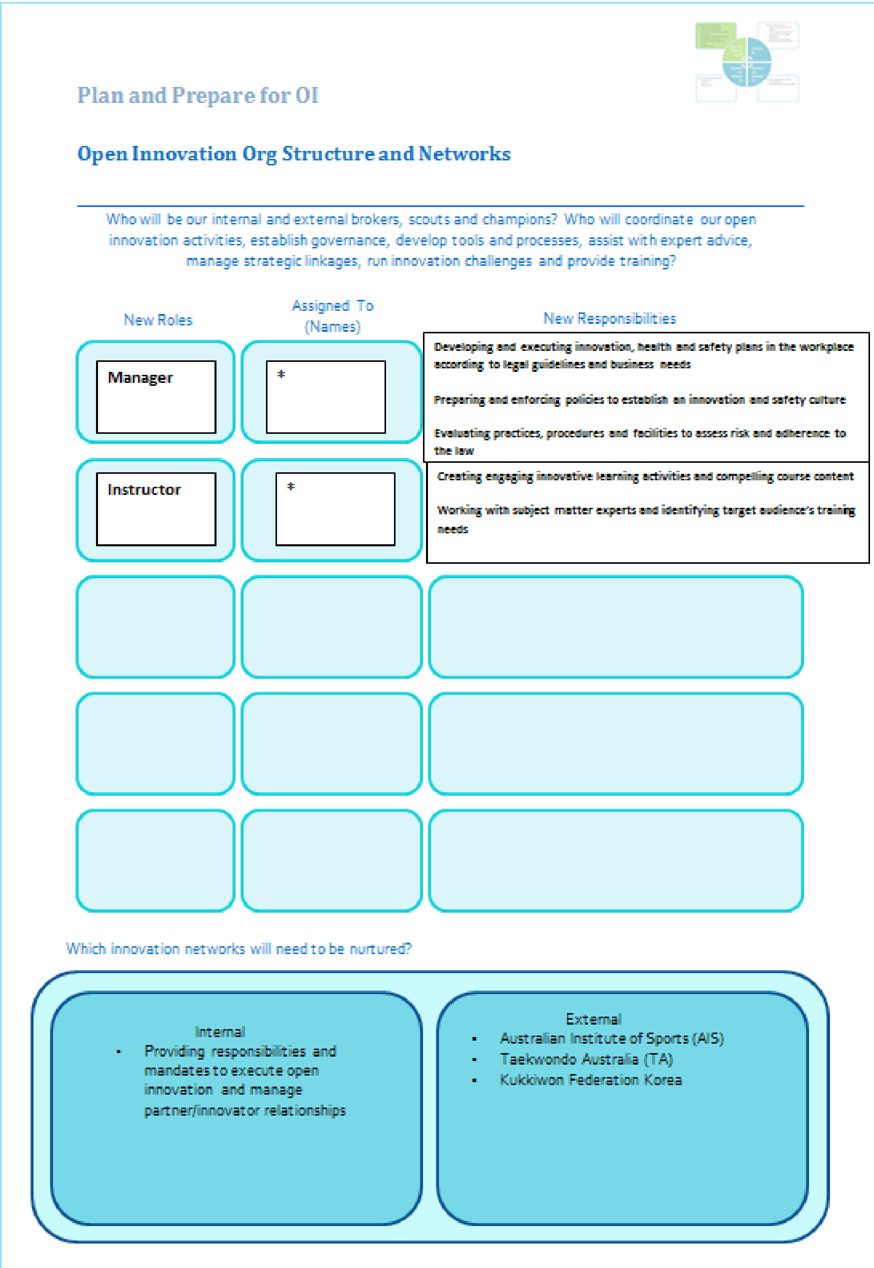


FIGURE 9-32: CASE 2 – OPEN INNOVATION ORGANISATION STRUCTURE AND NETWORKS (PAGE 2)

[6] The employee's names have been removed for privacy reasons

The readiness checklist was completed to move on to the 'Perform OI' phase.

Plan and Prepare for OI

Open Innovation Enabling Factors

Context	Interaction	Mechanism	Outcome
Open Innovation Enablement requires Enabling Factors (C14)	Such as the implementation of clear policies (I14.1), managing change (I14.2) and a final readiness assessment (I14.3)	Strengthening governance (M14.1) and leveraging industry change frameworks (M14.2) and readiness checklists (M14.3)	For an enabling environment to execute Open Innovation (O14)

Have we considered everything in our checklist below?

	For Proposers...	For Seekers...	
DEFINITION	Can you define what you offer to external partners on your own? Or is the knowledge you wish to share more of the sort where your new partners have to share their needs first before relating to them?	Can you define the idea / knowledge you are looking for? Is it something specific related to a well defined problem? Or are you looking for a surprise instead?	✓
VISIBILITY	Do you know your strengths? Do others know your strengths? Enough to make them consider you a partner? Are you visible enough for external partners?	Do you know where to look for possible new ideas? Are you able to motivate external thinkers to visit you and share their ideas? Or do you have to hunt for the new external ideas on your own?	✓
COMMON BENEFIT	Have you any idea how to come to a win-win agreement with your partner candidates? What would you offer for your future partners? What is going to be your benefit?		✓
PROTECTION	Do you have the measures to protect the rights and interests of both parties while coming to this agreement? Did you consider intellectual property issues thoroughly? Are there certain things you should avoid to share?		✓
METHODOLOGY	Who is going to be responsible for keeping the established cooperation alive? Can you work together with external partners continuously on a solution? Are your employees accepting external ideas to use them as their own? Who is covering the costs of the collaboration (being available, etc.)?		✓
STRATEGY	Have you defined what you want to achieve through Open Innovation? Has it been clearly communicated to the organisation? Do you understand your chosen method of engagement and where you want to open up your innovation efforts?		✓
OIL FRAMEWORK	Have you reviewed all the sections of the OIL Framework under Enabling Open Innovation? Do you have dedicated resources for the implementation, execution and improvement of Open Innovation?		✓

Are we ready to proceed? ✓ Yes No

Adapted from OPINET – OPEN INNOVATION BEST PRACTICE GUIDE

FIGURE 9-33: CASE 2 – OPEN INNOVATION ENABLING FACTORS

The specific innovation need was identified for the organisation.

Perform OI

Open Innovation Opportunity Discovery and Ideation

Context	Interaction	Mechanism	Outcome
When performing Opportunity Discovery and Ideation (C15)	Define the needs that will be addressed by the ideas to be sourced (I15.1; L,T,D), select the ideation partners to work with and methods to obtain ideas (I15.2;L,T,D), and run idea campaigns (I15.3;L,T,D)	Using appropriate platforms to capture ideas (M15.1) and incentives to increase participation (M15.2)	Resulting in a pipeline of new innovation ideas and opportunities (O15)

What is the unmet need we are trying to solve?

Modernise Martial Arts training routines to retain existing and potentially attract new students.

Whose unmet need is this?

Customers currently have this unmet need

Why is it important to meet this unmet need?

To retain existing and potentially attract new students.

Why has this need not been satisfied before / by someone else?

Most schools find it very difficult to find the right balance between traditional cultural approach vs modern training methods due to student diversity in terms of age and subject matter knowledge of martial arts.

FIGURE 9-34: CASE 2 – OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 1)

iTaekwondo decided to follow a Suggested Closed Network approach to attract new students and select a partner for innovation.

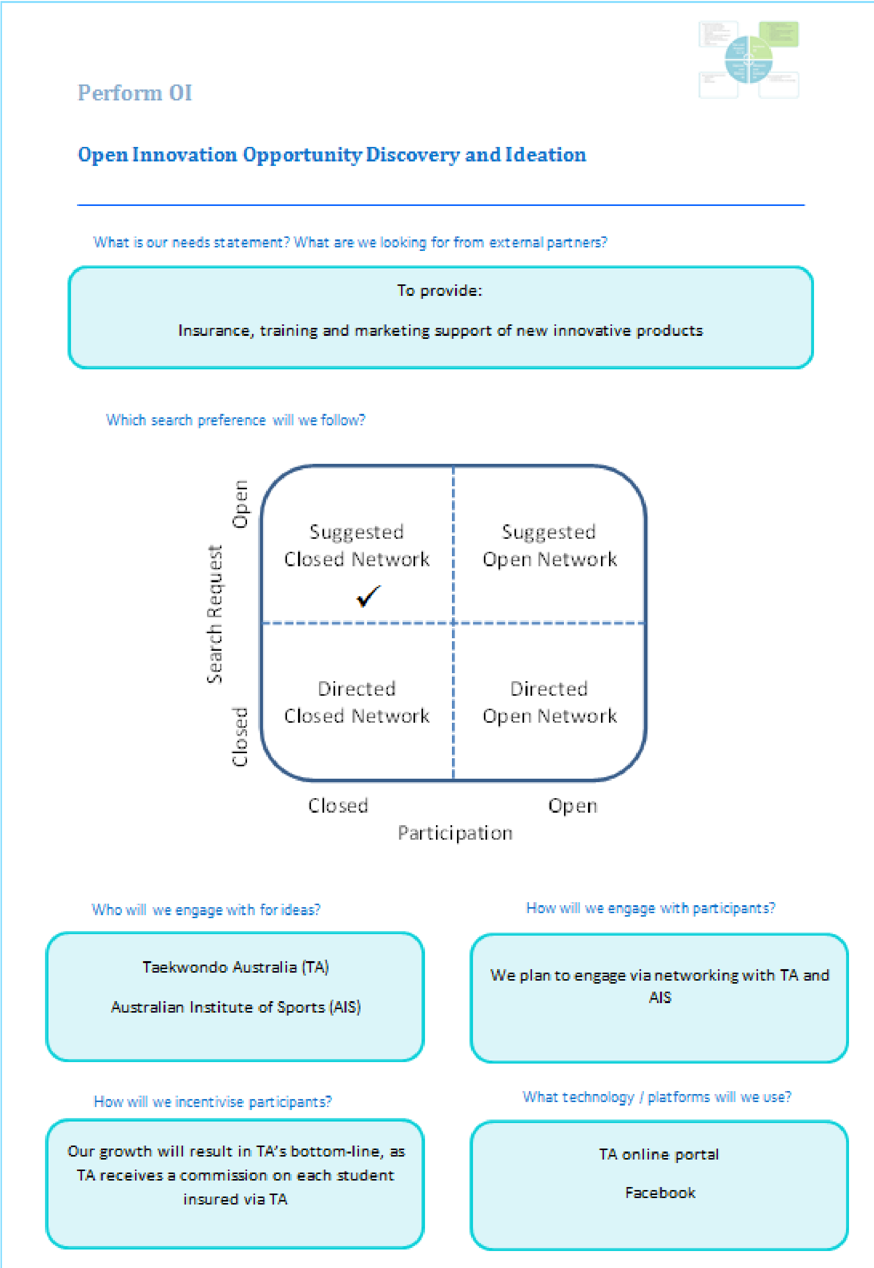
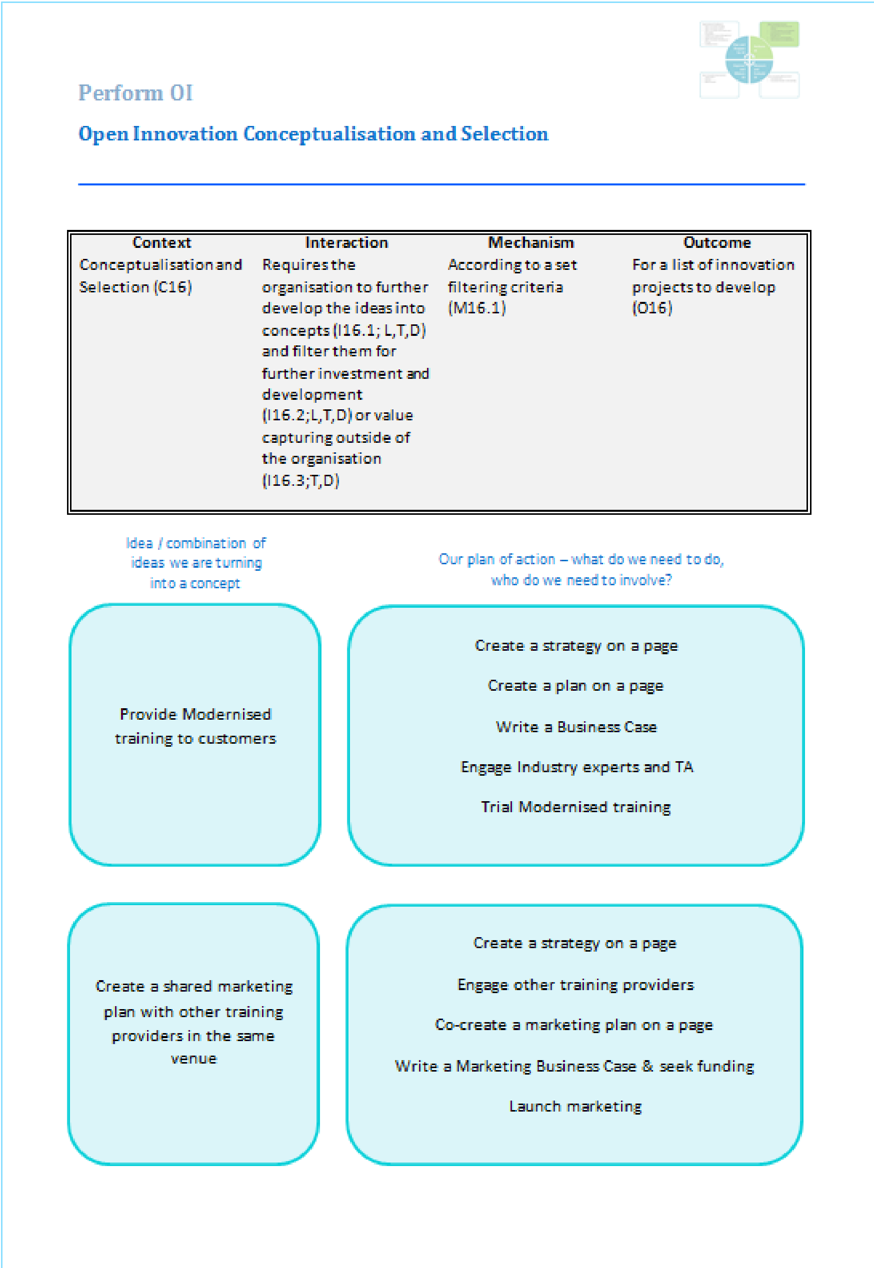


FIGURE 9-35: CASE 2 – OPEN INNOVATION OPPORTUNITY DISCOVERY AND IDEATION (PAGE 2)

Two concepts were developed for consideration.



Perform OI

Open Innovation Conceptualisation and Selection

Context	Interaction	Mechanism	Outcome
Conceptualisation and Selection (C16)	Requires the organisation to further develop the ideas into concepts (I16.1; L,T,D) and filter them for further investment and development (I16.2;L,T,D) or value capturing outside of the organisation (I16.3;T,D)	According to a set filtering criteria (M16.1)	For a list of innovation projects to develop (O16)

Idea / combination of ideas we are turning into a concept

Our plan of action – what do we need to do, who do we need to involve?

Provide Modernised training to customers

Create a strategy on a page
Create a plan on a page
Write a Business Case
Engage Industry experts and TA
Trial Modernised training

Create a shared marketing plan with other training providers in the same venue

Create a strategy on a page
Engage other training providers
Co-create a marketing plan on a page
Write a Marketing Business Case & seek funding
Launch marketing

FIGURE 9-36: CASE 2 – OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 1)

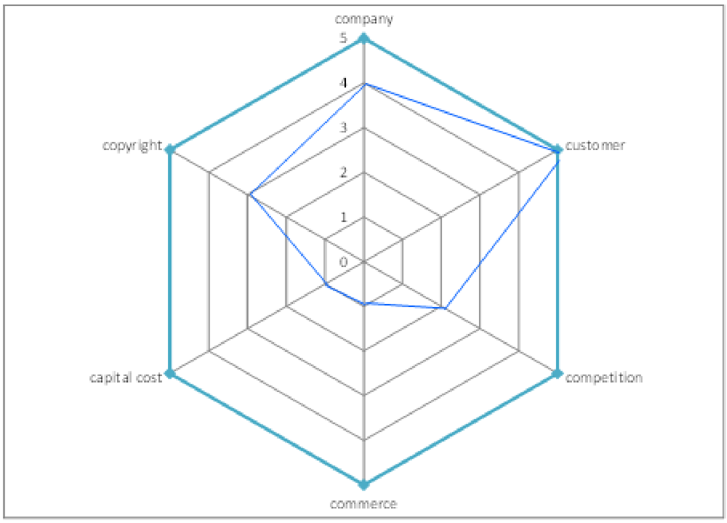
Only the first concept was plotted on the web diagram. It was decided to hold off with the second concept until more information could be gathered on its feasibility and to allow for the first concept to be developed first.

Perform OI

Open Innovation Conceptualisation and Selection

We need to filter concepts for promotion to our development phase. How does the concept score on the following criteria?

CONCEPT NAME: Modernised Training



Company: Strategy fit, competitive context, prevailing economics, and positioning within the value chain

Customer: Utility, customer preference, addressing a problem to solve

Competition: Uniqueness of the opportunity, competitive advantage

Commerce: Market size, market barriers, growth opportunity

Capital Cost: Internal capability to leverage, investment costs and time

Copyright: Intellectual Property mechanisms, ease of protection, cost of protection

Note: also consider completing a business model canvas and or value proposition canvas for your concept to help understand the potential of your innovation.

FIGURE 9-37: CASE 2 – OPEN INNOVATION CONCEPTUALISATION AND SELECTION (PAGE 2)

9.4 Expert Reviews

Feedback was also obtained from experts with experience and exposure to open innovation and/or SMEs, to obtain a deeper perspective on the approach from a theoretical perspective. Feedback was obtained on the approach using the questionnaire mentioned in the previous section. Again, the detailed responses are provided in Appendix B, with the most relevant feedback being discussed next.

9.4.1 Expert 1

9.4.1.1 Expert Profile

Name and Surname: Dr Heinz Essmann

Country: South Africa

Profession: Consultant / Engineer

Industry: Consumer Products

Dr Essmann has been involved in open innovation for more than seven years. He has had exposure to SMEs and larger organisations, but is currently involved in innovation in large organisations; sometimes utilising open tools. His involvement in innovation spans strategy and implementation.

9.4.1.2 Feedback Summary

Dr Essman considered the approach to have value for application by SMEs looking to adopt open innovation within their organisations. He considered the supporting meta-model to be strong, but pointed out that more examples could help the user to better understand the application of the approach.

> *"Design propositions cover a broad range of considerations. No model is complete in all circumstances, but this model should add value to most, if not all, SMEs looking to practice open innovation. The metamodel behind the DPs follows classic design/change thinking; this cannot be faulted. One addition, not necessarily vital in the completion of a PhD, but certainly valuable to any person or team looking to understand and utilise any of the DPs would be to provide actual examples of completed DPs from a 'real world' example."*

Dr Essmann thought that the approach could be used as a management aid for SMEs, but also added suggestions for the improvement of the contextual flexibility of the approach and on how the templates could be enhanced.

> *"I believe this [considering the context of the user] a tough ask of any generic model. Again, a couple of examples could provide contextual alignment. Or, facilitated use of the DPs and the surrounding approach, could do this. The templates could be embellished with short definitions of new or specific terminology for quick reference (i.e. summaries of definitions from the detailed explanation) rather than paging between. A spreadsheet with links, app or webpage could provide for a more interactive environment. (Again, this not for academic purposes! Only relevant to a practical application.)"*

Dr Essmann was comfortable with the references included in the approach.

> *"There are always different views; but not that I feel MUST be included."*

The importance of Human Capital in the success of the adoption and use of any model within an organisation was stressed, but also acknowledged that good models can improve the performance of teams.

> *"I think that models help. But, they cannot replace Human Capital; a significant deficiency in this area will not be plugged by any model. But a good model can make a good team better. I believe this model will help."*

9.4.2 Expert 2

9.4.2.1 Expert Profile

Name and Surname: Dr Anthon Botha

Country: South Africa

Profession: Technology, Innovation & Knowledge Management Consultant

Industry: Consulting

Dr Botha has more than seven years' experience in open innovation and focuses predominantly on SMEs, albeit with interaction with larger organisations for innovation partnering. He is an academic and consultant, focusing on strategy and implementation.

9.4.2.2 Feedback Summary

Dr Botha provided very comprehensive feedback on the survey, which he followed up with a Skype call to discuss the feedback further. He was positive about the approach and value of the survey, but provided specific feedback based on his own experience of consulting to SMEs that generally engage in innovation with larger organisations.

> *"The design proposition focuses on SMEs. Yet, there is not a similar concept available for large organisations. Since most SMEs innovate (especially in OI) with large organisations, the concept has potential to be applied wider, also in large organisations and especially at the interface between organisations. The design propositions represent a very comprehensive collection of the relevant innovation issues in the application environments. As such it draws from a wide body of knowledge and integrates many aspects. The interrelationship among the elements of the design proposition may require some thought. In addition, an element of being able to assess the future environment may be useful."*

Dr Botha considered the approach specifically from the perspective of the SME and larger organisation interaction perspective, pointing out that there may be misalignment if the SME follows the approach, but the larger organisation does not implement a similar approach and how that could potentially cause difficulties in managing the relationship. He would therefore recommend a similar view for larger organisations to adopt and descriptions of how this interplay would work. This provides an important dimension to the approach and an understanding of the interactions between SMEs and larger organisations. It needs to be noted that this is not the only partner scenario that exists for SMEs, but future research work may have to consider these different scenarios of partner interactions and the implications for the parties involved.

He further suggested that it could be considered to enhance the templates to simplify their use by something such as a 'mind map' or similar visual navigation model to help the user through the implementation process and to demonstrate the interaction points. Minimum criteria for implementation to still get benefit was also questioned i.e. what is the minimum set of actions that the SME needs to take for the approach to add value.

> *"A logical path through the design propositions is outlined. When first looking at them they seem overwhelming and may result in difficulty in implementation. A high level, simplified graphical model is required that will become the mental reference for a user. This graphical model could be used as a 'lens' to look at a specific OI initiative, binding the innovation partners together and guiding them. It could also be used as an interfacial tool between partners, especially when they represent SMEs and large entities that innovate together. The vast number of issues addressed make the model, albeit a good theoretical one, slightly difficult to implement. There is also not enough information in the material provided to fully understand the way the templates will be used and what the holistic outcome will be. Some of the templates also need more detail, since all aspects leading to an understanding of the model and a guiding OI tool, are missing. The driving links among the different elements need to be reinforced and the focus on an outcome is required.*
>
> *From the information provided for the validation, it is not clear how customisation is allowed, although it is clearly stated that the model is flexible. It is not clear at present how the boundaries are defined and what the minimum approach would be to still get sufficient guidelines from the OI model. The templates, specifically, have major gaps in terms of guiding a user towards a unified adoption of the approach. It does consider the context of the user in terms of size and internal capability to innovate. It is not obvious that it addresses the 'conjunctural context of the user. How does it support the OI team consisting of multiple partners? It may prepare individual OI partners, but it is not aimed at the collective where the innovation takes place. The model can be made more appealing by using more visualisation to support a thought or mind model, in addition to the very complete write-up provided. There should be a visualisation of the model, its position and role in an OI initiative, its links to the templates and its link to the OIL Framework, as well as, and very importantly, the expected outcomes for the OI partners. The templates have the right level of visualisation, but should be revised to address all aspects of the CIMO logic.*
>
> *The templates are well-designed and lead the user to extracting and supplying the right information. Apart from previous comments that not all aspects of the CIMO are addressed equally in all of them, they are stimulating in their design."*

Dr Botha was comfortable with the level of references used within the approach and complimentary on pulling together a varied number of concepts together into a single approach.

> *"A very substantive reference list is provided. The references address a diverse spread of views that were combined into the new approach and are adequate. The approach is comprehensive and addresses some fragmentation and gaps in OI practice. It provides a holistic view of many individual aspects that are addressed in context of OI. The approach represents an innovation in itself - it takes existing concepts and combines them in such a way that they have new value to the user."*

9.4.3 Expert 3

9.4.3.1 Expert Profile

Name and Surname: Mr VDS Brink

Country: South Africa

Profession: Consulting, lecturing, writing

Industry: Consulting

Mr Brink is an advisor/consultant and academic with more than seven years' experience in innovation, focusing on strategy and implementation within SMEs and larger organisations.

9.4.3.2 Feedback Summary

Mr Brink was excited about the approach and the potential benefit it could have for SMEs and considered the design propositions comprehensive for the implementation, execution and improvement of open innovation in SMEs.

> *"After working with dozens of SMEs and large organizations, the theory makes great sense. Getting more structure in our innovative efforts makes all the difference."*

He also suggested that the approach could be simplified for easier implementation.

> *"It is somewhat complex to follow, yet anything can be simplified if needed. More pictures and diagrams with less words to be a next step."*

Mr Brink believed the approach would be beneficial as a management aid and that it is flexible and generic enough to be used by SMEs.

> *"In SMEs, the focus is on production and marketing, losing sight of the bigger picture and those small things that can make a big difference. Working with factories, IT, education ... same thing and applicable."*

Mr Brink also commented on the importance of the social human element in the success of implementing an innovation model in an organisation.

> *"Business is a people contact game. More references to work on psychology and sociology is critical to enlighten change."*

Mr Brink considered the approach very useful and commented that he is planning on using the approach in future in his own work with SMEs.

> *"I love it and plan to apply [the approach] in the near future."*

9.4.4 Discussion

The feedback received from the subject matter experts was positive, albeit more expansive and critical than received from the SMEs. The experts acknowledged the difficulty in combining a vast resource pool of information and packaging it into an accessible and useful approach for SMEs to use. The approach should be recognised for what it is – a toolset for SMEs to use within their organisations for open innovation. It was designed to meet the design requirements set out in chapter 5 and balances the need to be generic with specific function (see design restriction R1 and user requirements U2 and U3 in the design requirements).

The approach provides a fully packaged approach, considering the theoretical grounding required for academic research. This provided a challenge when assessed by the subject matter experts. Feedback was that some of the content could be too overwhelming and too much for easy implementation and adoption. A request for further simplification and visualisation also clearly came out. This highlights the clear tension between academic models and 'consulting' models. It is therefore acknowledged that for the open innovation approach to be used as a consulting tool, it would need further simplification, but that the academic fullness provided in this dissertation is required in the initial design and development of the approach. Customisation can then follow.

It was also requested that more examples be provided with the open innovation approach to demonstrate the use of the approach and templates. The illustrative case provided in section 5 can help to address this gap in the initial material provided to the participants.

Dr Botha commented in his feedback that a view showing the partner interactions during the approach (especially when partnering with large organisations) would be of benefit. It would provide a perspective of the different responsibilities and interactions required between partners based on their roles in the open innovation relationship. This was not part of the initial scope of the approach, but it is acknowledged that this will indeed be an interesting extension of the approach and will be identified as an area for future research in chapter 10.

9.5 Survey Summary

The approach validation survey was sent out for completion to three SME owners and to three subject matter experts within the field of innovation. They were asked to review the open innovation approach and then to answer the survey questions.

The questionnaire covered five main sections:

1. Design Propositions and Approach
2. Templates
3. References
4. General
5. Overall Rating

The survey contained 24 questions related to the approach and 11 demographic and background-related questions. The survey was set up to test the utility of the approach and the questions were framed around the use of the approach and to answer the user and functional design requirements defined in chapter 5.

9.5.1 Survey Protocol

All survey participants were provided with the design propositions, detailed descriptions and templates in electronic format prior to completing the survey. They could then complete the survey using the tool SurveyMonkey. One SME chose to complete the survey in MSWord.

Two of the three SME owners had a Skype call with the author prior to their completing the survey, to help explain the use of the content from a user perspective. The third SME was taken through the content in person (due to proximity).

The subject matter experts were given the option of a Skype call prior to completing the survey, but this was not taken up by any of them. One participant did however provide explanatory feedback via a Skype call after completing the survey. The subject matter experts were chosen based on their knowledge and experience within open innovation and SMEs. All three have a strong academic and practical background and are active within the Industrial Engineering community within South Africa.

All three SME owners were known to the author prior to the survey. Two of the owners also participated in the survey study of South African SMEs from chapter 4 (as part of the pilot group) and had an interest in the approach as a result of the initial study.

9.5.2 Results Overview

Following is a summary table of all the rating responses from the survey completed by the subject matter experts and the SMEs. The table indicates the number of responses received from each response group per question.

TABLE 9-2: VALIDATION SURVEY RESULTS

Survey Questions	Agree		Slightly Agree		Slightly Disagree		Disagree	
	SME	Expert	SME	Expert	SME	Expert	SME	Expert
1. Design Propositions and Approach								
1.1. Are the design propositions comprehensive for the implementation, execution and improvement of open innovation in SMEs?	2	3	1					
1.2. Are the design propositions logical? Do they make sense and can they be followed?	3	2		1				
1.3. Do you consider the approach to be user-friendly – i.e. easy to adopt, understandable, and easy to use?	2		1	3				
1.4. Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	3	2		1				
1.5. Does the approach consider the context of the user?	3			3				
1.6. Can the approach be considered as a management aid for implementing, executing and improving open	3	2		1				

Survey Questions	Agree		Slightly Agree		Slightly Disagree		Disagree	
	SME	Expert	SME	Expert	SME	Expert	SME	Expert
innovation within SMEs?								
1.7. Does the approach support repeated and continued use?	3	2				1		
1.8. Does the approach provide clear definitions and explanations?	2	2	1	1				
1.9. Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	3	2				1		
2. Templates								
2.1. Are the templates user-friendly?	3	2						1
2.2. Are the templates understandable?	3	2		1				
2.3. Do the templates aid in the use of the approach?	3	2		1				
2.4. Is the structure/layout of the templates appropriate?	3	1		1				
3. References [7]								

[7] SMEs weren't expected to complete section 3 providing an opinion on literature sources

Survey Questions	Agree		Slightly Agree		Slightly Disagree		Disagree	
	SME	Expert	SME	Expert	SME	Expert	SME	Expert
3.1. Do you think that sufficient references are included, on which the approach is based?		3						
3.2. Are there references with different views which you feel should have been considered?				1	1			1
3.3. Do you consider the design propositions and approach as reflective of current best practice in the evolving field of open innovation?		3						
4. General								
4.1. Do you think that applying the approach will increase an organisation's chances of achieving success in open innovation compared to not following the approach at all?	2	1	1	2				
5. Finally, please rate the approach (design propositions and templates) overall in terms of being:								
5.1. Usable	2	2	1	1				
5.2. Comprehensive	3	2		1				
5.3. Understandable	3	1		2				
5.4. Appealing	3	1		2				

9.5.3 Discussion

The overall feedback on the approach was positive, with most of the ratings being in the positive two quadrants of the scale. Feedback received from the SMEs tended to be more positive, with the subject matter experts providing more critical feedback and assessments. One subject matter expert disagreed with the statement that the templates could be considered user-friendly (more detail provided in section 4). No other 'disagree' ratings were received, other than for the question on the requirement to include additional references (where a disagree rating is seen as a positive answer).

The survey results indicate that the approach is considered useful and would be a good tool for SMEs to use within their organisations for open innovation. It covers the overarching objective of an approach for SMEs to use for implementation, execution and improvement of open innovation. It also addresses the requirements for the design set out in chapter 5. Constructive feedback was provided for improvement (further discussed in the subsequent sections), but ratings were satisfactory towards validating the approach relating to the design requirements.

9.6 SME Reviews

This section will discuss the review feedback from the three SMEs. The reviews were done to obtain the perspective of potential users of the approach. Following is a reflection on the main feedback provided by the SMEs.

9.6.1 SME 1

9.6.1.1 SME Profile

The SME is a knowledge capital consultancy focusing on identifying, leveraging and measuring the value of knowledge assets in small- to medium-sized businesses in South Africa. The company has three employees and has been in business now for three-and-a-half years.

9.6.1.2 Feedback Summary

The feedback provided was very positive overall, with none of the questions being rated in the negative part of the scale.

The approach was considered to support repeated and continued use, with the SME owner stating that

> *"This is an approach that an SME can become comfortable and familiar with and use as a strategic tool".*

A strong aspect of the approach was considered to be that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability.

Feedback regarding the templates were that they serve a couple of purposes:

- Pull the approach together into a practical application
- Allay the fear of where to start – what are my first next steps
- Being transparent and practical makes it encouraging for the SME to use the framework

There were also some suggestions for improvement provided by the SME owner, stating that

> *"I feel that the approach is comprehensive, but I am reticent to agree that an SME will be able to implement this on their own the first time – especially if they are new to the whole concept of open innovation. Suggest compiling a glossary of terms for quick reference for the newly initiated into the open innovation space. Perhaps a suggestion for the future is a dashboard template that gives the user a high level overview of their particular information".*

The SME was positive about the flexibility of the approach and that SMEs can adapt it to their own specific circumstances. There was, however, uncertainty whether other such approaches exist and how those approaches would compare to this given approach.

> *"The approach enables the user to gain a landscape view of the open innovation opportunity (or an area within strategic capital as we Knowledge Capitalists like to frame innovation). The approach allows for customisation by the user, so there are no fundamental constraints that will prevent the user from making it their own. I definitely think that the approach offers SMEs more of an opportunity to achieve success than not having any approach at all.*
>
> *I am however not in a position to comment on whether following this particular approach is superior to following other existing approaches (if any)."*

Closing comments were very encouraging in supporting the usability of the approach through the following statements:

> *"This is an approach that an SME can become comfortable and familiar with and use as a strategic tool. This approach is particularly refreshing as it seeks to extend the relationship capital of an SME, inviting clients, partners, and vendors etc. to participate in the innovation process and creating additional value for the knowledge assets of the organisation. This plays into the business model of the SME and can provide an entirely new income stream for the organisation. I feel that this approach opens up new avenues for SMEs who are on various levels to participate, experiment and grow their business while still having to deliver business as usual. This is a very exciting piece of work – as an SME, it offers a practical way to participate in open innovation".*

9.6.2 SME 2

9.6.2.1 SME Profile

The SME runs team building and youth camp events. They describe themselves as a professional team building company that facilitates experimental-based activities, offering exciting team building programmes that suit everybody's needs. They offer over 100 different activities and more than 15 different programmes. The company has five full-time employees and has been in business for 10 years.

9.6.2.2 Feedback Summary

The feedback provided was very positive overall, with none of the questions being rated in the negative part of the scale. Limited comments were provided in the questionnaire with input for improvement.

> "*It was written and explained very thoroughly, very easy to follow.*
>
> *The templates have been designed with an everyday 'Joe' in mind.*
>
> *Any organisation will be able to run this system as it is currently, very simplistic but very insightful*."

During the Skype session with the SME, the owner was very excited about the approach, especially the templates and the ease of use. He was very keen to discuss them with his team and to see how they could use the ideas and tools to help them come up with new ideas for services in their organisation.

9.6.3 SME 3

9.6.3.1 SME Profile

The SME provides martial arts training for self-defence and family fitness. The business was established in January 2014 and has two employees. The martial arts business is not the owner's primary source of income, as he holds a full-time position working for another organisation.

9.6.3.2 Feedback Summary

The SME owner was positive about the open innovation approach and its potential application. He was especially excited about the ease and usefulness of the templates.

> *"Easy to use tool for effective results."*

The SME completed the first few templates of the approach (see section 5.2) as an example of its application for his own organisation. His was positive about the approach providing a structured way of thinking and to bring together ideas throughout the innovation life cycle.

> *"The open innovation approach has provided a sustainable model for success."*

He was surprised that for a small organisation such as his, this could be applicable and how useful it was to consider different open innovation options. During the face-to-face discussions regarding the approach, he also mentioned that he could see how the approach could be used in digital (app) format in the future to help organisations work through the open innovation life cycle.

9.6.4 Discussion

The feedback from the SMEs was very positive. The perspectives and ratings provided were from the perspective of overall utility i.e. will it be helpful for the SME to use in their own organisations. The quality and efficacy (Hevner et al., 2004) were also positively assessed, especially in the use of the templates.

The feedback received confirms that the open innovation approach will address the field problem defined for this research and meet the main objective for an approach for the implementation, execution and improvement of open innovation by SMEs.

During the open innovation survey in chapter 4, it was identified that SMEs often use open innovation concepts, but that these tend to be done in a very ad hoc fashion. The literature also raises the concern that SMEs tend to not follow structure (or formal) business management methods. From the feedback received on the open innovation approach, it became clear that formal approaches are welcomed by SMEs, but that these must be made accessible i.e. easy to use so as not to overwhelm or put too much additional resource constraints on the SME. The open innovation approach meets this criteria through the use of the user templates to enable the SME to engage more easily with the detailed content of the design propositions in the approach.

9.7 Chapter Conclusion

The verification and validation of the research took on various aspects as described by design science research methods (Venable et al., 2012; Hevner, 2004; Weber, 2011; Peffers et al., 2012). Evaluation and validation firstly looked at the research rigour applied to the study. For design sciences research, the design cycle should be connected to knowledge, experience and expertise (Hevner, 2007).

The design cycles of this research followed this approach throughout, ensuring the artefacts were grounded through literature, expert input and research output, as briefly set out below:

- Design requirements – based on the results of the study conducted under South African SMEs and also referring to the literature.
- Open Innovation Lifecycle (OIL) Framework – based on literature in the domains of open innovation, SMEs and business management methods, identifying and incorporating best practices and trends observed.
- Design propositions and detailed descriptions – based extensively on the literature on open innovation, SMEs and business management methods. Also incorporated insights and conclusions from the author to highlight differences specific to SMEs compared with larger organisations.
- Templates – based on the developed design propositions and detailed descriptions, following modern design approaches in management and business design.

A requirements adherence verification matrix was used to map the requirements for the approach to the produced artefact (Weber, 2011; Van Dyk, 2013; Tan, 2010). This produced a satisfactory result and showed alignment of the requirements to the approach. This provided further rigour from a methodological perspective and also addressed the utility of the artefacts and met the needs of the problem identified and of the design specifications (Tan, 2010).

Illustrative scenarios were also used to evaluate the approach (Peffers et al., 2012), during discussions with the SMEs before they completed the approach questionnaire, but also as a generic end-to-end example and a partial real-world example. This provided insight into the utility of the approach. The end-to-end example also served as useful artefact to be used in conjunction with the approach by SMEs looking to implement it in their organisations and wanting further reference material to assist them in this process.

The approach was further taken through steps of validation for quality and utility (Van Aken, 2005) by obtaining two perspectives, from potential users in SMEs and from experts. The approach was evaluated using a formal questionnaire to obtain feedback. The feedback provided valuable insight into the theoretical and practical nature of the approach, linking it to the relevance cycle of the research methods (Hevner, 2007). The feedback identified areas for improvement of the artefacts, especially from the perspective of utility if considered as a consulting aid in its application.

From chapter 3, it was stated that design science research is focused on developing actionable knowledge that is grounded in evidence (Bate, 2007). Pawson (2006) followed a realist synthesis approach, utilising intervention-outcome logic within various contexts. Denyer et al. (2008) expanded on this concept, introducing CIMO-logic. "This logic involves a combination of a problematic Context, for which the design proposition suggests a certain Intervention type, to produce, through specified generative Mechanisms, the intended Outcome(s)" (Denyer et al., 2008). Grounding of the design proposition was achieved through the use of the generative mechanisms in the CIMO-logic (Van Aken, 2005; Pawson & Tilley, 1997) drawing from insights in literature and theory. Making use of the CIMO-logic and research synthesis throughout the development of the design propositions, provided the necessary grounding as described for this type of research.

Chapter 10: Conclusions

10.1 Research Method, Argument and Conclusions

The final chapter reflects on the research contribution of this dissertation in the context of the research method, research problem and research questions. It considers the research deliverables achieved and the opportunity for future research related to the outcome of this study.

10.1.1 Execution of the Research Method

Chapter 1 of this study explored the research problem space of SMEs, open innovation and business management methods. The main research question was defined as

- Question: *How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?*

The associated main research objective was defined as

> Objective: *To develop an approach that can be used by SMEs in the implementation, execution and improvement of open innovation in their organisations.*

Following from the above, the secondary research questions and objectives were then defined as

> SRQ1: Why should SMEs consider using open innovation?
>
> SRO1: To determine the argument for using open innovation in SMEs based on the established literature
>
> SRQ2: What is the appetite for and use of open innovation in SMEs within South Africa?
>
> SRO2: To determine the appetite for and use of open innovation in South African SMEs.
>
> SRQ3: What are the design requirements for an open innovation approach for SMEs?
>
> SRO3: To determine design requirements for an open innovation approach for SMEs.
>
> SRQ4: What framework can be developed for an open innovation approach for SMEs?
>
> SRO4: To develop a framework for an open innovation approach for SMEs.
>
> SRQ5: What design propositions can we develop for an open innovation approach for SMEs?
>
> SRO5: To develop design propositions for an open innovation approach for SMEs.

A design science research method was followed for this research. Following the philosophical paradigm of pragmatism associated with action, intervention and constructive knowledge, the aim was to produce an artefact whose value was determined by its usefulness in achieving a certain outcome.

This research followed the design science research method proposed by Peffers et al. (2008). The research design was based on five steps:

1. Problem Identification and Motivation
2. Definition of Solution Requirements
3. Design and Development
4. Demonstration and Evaluation

5. Communication

The first two steps, following a process of induction, focused on gaining an understanding of the 'field problem to be solved'. It included a literature review (chapter 3) to establish baseline information and to understand the argument for the use and impact of using open innovation in SMEs. Furthermore, an initial survey was conducted with South African SMEs to better understand the appetite for and use of open innovation in their organisations (chapter 4). This survey confirmed the requirement for a more formal open innovation approach for SMEs and support in its implementation and use.

Solution requirements were developed for the approach in the form of design requirements (chapter 5). The design requirements were structured under user and functional requirements, design restrictions, boundary conditions and attention points. These requirements were derived based on the survey and other literature.

The third and fourth steps of the research design followed a process of deduction. The approach was developed through an iterative design process, each building on the output of the previous step. During this step, the OIL Framework (chapter 6), design propositions (chapter 7) and open innovation approach templates (chapter 8) were developed. The design artefacts were developed in a constructivist approach through a process of abstraction and synthesis from models and frameworks in the literature. The design propositions were composed following CIMO-logic.

Demonstration and evaluation of the research artefacts aimed to demonstrate utility, quality, and efficacy (chapter 9). The output was evaluated against the design requirements, set during step two of the research design. Expert and user feedback was also obtained regarding the approach, supported by illustrative cases. Peer-reviewed papers were also produced throughout the research period to further aid in the evaluation of the open innovation approach artefacts.

Communication of the research was done through research papers presented at conferences and published in science journals. This dissertation further serves as a form of communication.

10.1.2 Research Conclusions Relating to the Research Method

Hevner (2007) stated the requirement of three cycles or principles for design science research. They are Relevance, Rigour and Design.

10.1.2.1 Relevance

This research addressed the problem of innovation within SMEs. During the literature review in chapter 2, it was shown that open innovation can have a positive impact on the innovation capability, output and revenue generation of the SME. It helps to overcome barriers of 'smallness' often associated with SMEs. Following a more formal approach to open innovation was, however, stressed in the literature to achieve these aforementioned benefits.

The survey conducted with South African SMEs in chapter 4 also showed that there is a need for a formalised approach for SMEs to use to implement, execute and improve open innovation in their organisations. The survey highlighted the appetite for using open innovation within SMEs, making this research a relevant field problem to solve. The SME sector plays an important part as a large economic contributor and employer, which means that improved innovation capability not only benefits the organisation, but also the wider economy and society. This further emphasised the relevance of research on innovation within SMEs.

During the validation discussion in chapter 9, it was also indicated by the respondents to the validation survey, that they considered the approach to be relevant and of value for use as an open innovation aid.

10.1.2.2 Rigour

The rigour cycle should connect the design cycle with knowledge, experience and expertise to better ground the design artefact. This research conducted an initial literature study to understand the current state of the art. The literature indicated that limited research results are available on open innovation within SMEs. Research tends to focus more on larger organisations. It was also found that there is a need for a formal open innovation approach.

During the design cycle of the open innovation approach, the research was grounded by drawing from the existing knowledge base and utilising available theories, frameworks, methods, processes, expertise and other artefacts relevant to the problem and design space. Literature pertaining to open innovation (within SMEs and large organisations) and business management methods was consulted through a process of research synthesis to construct the OIL Framework and the design propositions, including the detailed description notes.

Rigour is further applied by following the five-step design sciences method as per Peffers et al. (2008), discussed in section 10.1.1. It provides a scientific approach to the study, grounded in the philosophical paradigm of pragmatism.

The rigour cycle is completed through the flow of knowledge back into the knowledge base in the form of the developed artefacts – the OIL Framework, the design propositions and description notes, and the open innovation templates – contained in the open innovation approach.

10.1.2.3 Design

Artefacts were developed through an iteration of three design cycles. The first design cycle produced the OIL Framework, which provided boundaries for the design propositions. The framework was based on literature within the domains of:

- Innovation and open innovation
- Implementation and business management methods

Although planned as an open innovation framework for SMEs, it was found that this framework may have wider application for innovation in general.

The second design cycle developed design propositions for the open innovation approach. A process of research synthesis was followed to develop propositions framed by the OIL Framework, together with detailed description notes. The notes provide the user with the narrative of how the proposition was developed and also serve as a reference for users to assist in the application of the approach.

The third design cycle developed open innovation templates that users can employ as a summarised aid to the design propositions. They provide a visual tool that was viewed positively by respondents during the validation process.

The creative design process varied throughout the design cycles, with more free design practised during the template development and more constrained development during the design proposition development using CIMO-logic.

10.1.2.4 Pragmatic Validity

Hevner et al. (2004) stated that the utility, quality and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods with Denyer et al. (2008) calling for pragmatic validity. Chapter 9 discussed how validation was completed through survey responses from users and academics, together with illustrative cases. Furthermore, a comparison table was developed, mapping the original design requirements to the results, showing that all design requirements had been satisfied.

The illustrative cases showed how SMEs could apply the approach. The survey feedback also addressed the issues relating to utility and other features of the approach, which the respondents rated as positive.

10.1.3 Research Conclusion Relating to the Research Problem and Questions

One main and five secondary research questions were posed in this study. The following conclusions can be derived relating to the research problem and questions.

10.1.3.1 Secondary Question 1

SRQ1: Why should SMEs consider using open innovation?

A literature study was performed to answer the above question and gain a better understanding of the impact of using open innovation within SMEs. The literature indicated that SMEs could benefit greatly from open innovation as an innovation approach, with increased innovation output and revenue from new products and services mentioned as potential result. Open innovation could help SMEs overcome their 'smallness' giving them access to resources not otherwise accessible to them and speeding up the innovation cycle.

There are, however, some constraints that need to be considered, such as the breadth of innovation partners that can cause the benefit of open innovation to diminish as it passes a certain threshold. Absorption capacity factors must therefore be considered against the value that can be derived from open innovation. The need for more formal processes towards open innovation management was also mentioned as a requirement to derive more value.

Overall, however, based on the literature, there is a strong case to be made for the consideration of open innovation by SMEs.

10.1.3.2 Secondary Question 2

SRQ2: What is the appetite for and use of open innovation in SMEs within South Africa?

To answer the second secondary research question, a survey was conducted with South African SMEs. The survey results provided insight into the appetite for and use of open innovation in SMEs. Conclusions were that:

- SMEs make use of open innovation methods, but often do so in an ad hoc manner.
- Formal open innovation processes and fund allocation are rare.
- There is an appetite for using open innovation, but SMEs are not always confident in their own knowledge and ability to implement and use open innovation without assistance.
- Companies are at different levels of maturity when it comes to open innovation in their organisations.
- Open innovation methods with innovation partners where close ties have been established are preferred to weak ties options that require more resources and effort from the SMEs.

10.1.3.3 Secondary Question 3

SRQ3: What are the design requirements for an open innovation approach for SMEs?

To develop design requirements for an open innovation approach, this study used as input the results from the open innovation survey under SRQ2, together with insights obtained through the literature. Twenty-six design requirements were developed for the open innovation approach, grouped into five categories. The design requirements guided the development of the approach and also served as a checklist to be used during the validation step to make sure the final artefacts did address the requirements. The design requirements were also published as an article in the South African Journal for Industrial Engineering, where it underwent a peer-review process.

10.1.3.4 Secondary Question 4

SRQ4: What framework can be developed for an open innovation approach for SMEs?

The Open Innovation Lifecycle Framework (OIL Framework) was developed, through a process of abstraction, drawing from the literature and following the design requirements developed in SRQ4. The original framework that was developed consisted of four life cycle phases with 6 framework elements, but this was then further refined during the design cycle of the design propositions to have only four framework elements.

The framework formed the first output of the design iterations within the research method's design step. Although the framework was then further used for the development of the open innovation approach, it was noted that the framework appeared general enough to be applicable not just for open innovation use by SMEs, but also for innovation in general and for larger organisations. Differentiation only really became apparent during the next level of detail, when the design propositions were developed.

It should also be noted that this was not the 'only' framework that could have been developed for an open innovation approach. The outcome of the framework, as with many design artefacts, is a combination of the knowledge base consulted and the creative process of the designer that constructs the artefact (Tan, 2010).

10.1.3.5 Secondary Question 5

SRQ5: What design propositions can we develop for an open innovation approach for SMEs?

During the second design cycle, 22 design propositions were developed using the OIL Framework as a basis. During a process of research synthesis, literature was distilled to define the design propositions. Each design proposition was preceded by detailed description notes that positioned how the design propositions were derived and how to better interpret each proposition. It provided references to the theory, tools and knowledge content that the user could consult when using the approach.

The detailed design propositions and description notes combined with the OIL Framework provided a much more relevant artefact for open innovation in SMEs than just the OIL Framework on its own. For instance, it pointed out specific nuances and differences between open innovation within larger organisations versus SMEs. Detail that could not be captured in the framework alone, making it a much richer tool for use by SMEs planning to implement, execute and improve open innovation in their organisations.

To further improve the utility of the approach, open innovation templates were developed that provided a visual tool for users that could, for instance, be used during workshops or group discussions. During the validation process, the templates were considered a valuable addition to the approach.

10.1.3.6 Main Research Question

MRQ: *How can an approach for SMEs be developed, for the implementation, execution and improvement of open innovation in their organisations?*

The main research question is positively addressed through the culmination of the different design artefacts, producing an open innovation approach for SMEs. The OIL Framework, the design propositions and detailed descriptions, together with the open innovation templates form the open innovation approach. It also satisfied the design requirements for such an approach.

It provided a practical solution to the originally defined field problem. The process of research synthesis abstracted practices from the literature relating to the thematic domains of innovation, open innovation and other business management methods such as project management, continuous improvement and performance management. This achieved an approach that incorporated business management methods into a formalised open innovation approach for SMEs, thereby providing a structured way to implement, execute and improve open innovation in their organisations.

The approach showed that business management methods, often thought to be more applicable to larger organisations, can be incorporated within an innovation approach for SMEs. The innovation maturity of the SME does, however, play a role in the selection and application of certain methods. Flexibility in the approach is therefore needed, refraining from a 'one-size-fits-all' viewpoint, but also dispelling the notion that business management methods are not applicable outside of large organisations.

10.2 Research Contribution

10.2.1 Main Research Deliverables

This research provided the following deliverables, contributing to the research field of innovation, specifically open innovation within SMEs:

- A survey report on the state of open innovation among SMEs within South Africa, showing the appetite for and use of open innovation within this business sector. Although only an exploratory study, this was the first of its kind within South Africa to provide a view on these questions, also comparing it to results from international studies.
- Design requirements for the development of an open innovation approach for SMEs. The design requirements provided clear guidance for the approach development process which could then be used to validate the adherence to these requirements after the approach was developed.
- The Open Innovation Lifecycle (OIL) Framework was a unique attempt at providing a framework for open innovation implementation and execution, which also added the dimension of continuous improvement to the framework. Combining management methods with innovation methods provided a generic, yet unique framework for application within the domain of open innovation.
- The open innovation design propositions with detailed descriptions created a rich artefact of descriptive knowledge that an SME can use for open innovation implementation, execution and improvement. It condensed a vast collection of information into a formal business artefact that can be used by SMEs as a management aid.

- The open innovation templates further simplified the use of the design propositions and together with the design propositions, descriptive notes and framework produced a full open innovation approach for SMEs. The open innovation approach made a contribution to the practical field of open innovation within SMEs, expanding the knowledge base which normally focuses more on the application in larger organisations.

10.2.2 Unique Contribution

The open innovation approach developed during this research provides an integrated way for SMEs to implement, execute and improve open innovation within their organisations. It formalises what is often an ad hoc manner to using open innovation methods and tools in these types of organisations and has been highlighted as a gap in the literature to have a 'cookbook' that SMEs can use for open innovation. It combines a myriad of open innovation and business management perspectives and tools into a usable approach for SMEs. It furthermore provides user-friendly templates for the SME to use when adopting the approach, providing an easier way to interact with the literature in a structured way.

The approach helps SMEs to answer the question of where to start with their open innovation journey or how to improve the capability in their organisation in one integrated approach. As at the time of writing of this dissertation, no similar open innovation approach developed through an academic research method and focusing on SMEs existed in the literature.

The open innovation approach addressed the field problem stated in the opening chapter of this document, providing a practical approach for use by SMEs. It also provides a strong contribution to the literature on open innovation, first by providing a consolidation of various literature sources and perspectives, but also by providing a strong base for future research within the field of open innovation in SMEs, using the various artefacts contained in the approach.

10.2.3 Publications

Throughout the research period of this study, papers and articles were published to communicate findings, but also to gain peer-reviewed feedback on the research on a continuous basis. The following conference and journal publications were produced:

TABLE 10-1: PUBLICATIONS

Paper Name	Published Space	Focus Area	Authors
An Exploratory Study on Preferred Open Innovation Types and Partners in South African SMEs	Proceedings of the 2012 IEEE IEEM, Hong Kong	Open Innovation Survey – preferred OI types and OI partners	Krause, W., Schutte, C.S.L. & Du Preez, N.
Open Innovation in South African Small and Medium-sized Enterprises	CIE42 Conference Proceedings, 2012, Cape Town, South Africa	Open Innovation Survey results	Krause, W., Schutte, C.S.L. & Du Preez, N.
A Perspective on Open Innovation in Small and Medium-Sized	South African Journal of Industrial Engineering	OI Survey overview and definition of the	Krause, W. & Schutte, C.S.L.

Paper Name	Published Space	Focus Area	Authors
Enterprises in South Africa, and Design Requirements for an Open Innovation Approach	May 2015, Vol 26(1), pp 163-178.	design requirements for an OI approach	
A Framework Towards an Open Innovation Approach for SMEs	IAMOT 2015 Conference Proceedings, Cape Town, South Africa	Open Innovation Lifecycle Framework	Krause, W. & Schutte, C.S.L.
Developing Design Propositions for an Open Innovation Approach for SMEs	South African Journal of Industrial Engineering November 2016, Vol 27(3) Special Edition, pp 37-49	Design propositions and open innovation templates	Krause, W. & Schutte, C.S.L.

10.3 Topics for Future and Related Work

The following topics are suggested for related future research:

- Longitudinal studies – This study made use of expert and user feedback during the validation phase to test the utility of the open innovation approach. A longitudinal study could be conducted to test the effectiveness of the approach in an organisation that applies the approach and takes it through one or more life cycles. A comparative study between multiple organisations or different organisation sectors could also be conducted.
- Maturity impact analysis – The research proposed three different open innovation maturity levels for SMEs. A study could be conducted to understand the impact of utilising open innovation at each of these maturity levels against innovation performance i.e. is there a larger effect for innovation output and success when utilising open innovation for an organisation with a lower level of maturity than for an organisation with a high level of maturity?
- Factor analysis – Understanding which factors contribute most to open innovation success can be beneficial for organisations to better focus their innovation efforts. An analysis could be conducted using the design propositions as factor variables to understand success impact.
- SME and innovation partner interactions – according to the feedback received during the validation process, the open innovation approach could be further expanded to understand the interactions between innovation partners. Research could be done to understand the different touch points and considerations required during these interaction processes. Also, an understanding could be attained of the differences in interactions between partners of different sizes and how that impacts the partnership relationships and required interaction activities.

10.4 Concluding Remarks

Open innovation is still a relatively new research area, especially research pertaining to SMEs. Developing the open innovation approach contributes to this ever-developing domain of knowledge, not just on a theoretical level, but also on the level of practical application. It attempts to address the expressed need by other researchers and practitioners within the domain of open innovation to provide a guide that SMEs can use during their innovation journey, whether they be starting out or more advanced.

Innovation is an important part of the growth – and even survival – of any organisation. Opening up the innovation process and tapping into an extended knowledge and skills base is becoming a strategic imperative for organisations aiming to be competitive in their industries. Assisting SMEs in this quest through the open innovation approach will hopefully contribute to more successful open innovation practices being followed and unlocking value for SMEs. The open innovation approach can break the perception that open innovation is out of reach for most SMEs and that it is rather a practice that should be dominated by larger organisations. Indeed, with the approach, it helps SMEs to compete with larger organisations. The open innovation approach becomes a track for SMEs to run faster and in the right direction, making them much more efficient and competitive.

List Of References

Adams, R., Bessant, J. & Phelps, R. 2006. Innovation management measurement: A review. *International Journal of Management Reviews*, 8(1):21–47.

Adcorp Employment Index. 2012. [Online] Available: www.adcorp.co.za. [April 2012].

Alexy, O., Criscuolo, P. & Salter, A. 2009. Does IP strategy have to cripple open innovation? *MIT Sloan Management Review*, 51(1):71-77.

Almquist, E., Leiman, M., Rigby, D. & Roth, A. 2013. *Taking the measure of your innovation performance*. Bain & Company.

Andries, P, & Faems, D. 2013. Patenting activities and firm performance: Does firm size matter? *Journal of Product Innovation Management*, 30(6):1089–1098.

Andriessen, D. 2004. Reconciling the Rigor–Relevance Dilemma in Intellectual Capital Research. *The Learning Organization*, 11 (3).

Arrigo, E. 2012. Alliances, open innovation and outside-in management. *SYMPHONYA Emerging Issues in Management*, 2:53-65.

Australian Research Council (ARC). 2011. [Online] Available: http://www.arc.gov.au/general/glossary.htm [March 2011].

Barger, R.N., 2001. *Philosophical Belief Systems*. [Online] Available: http://www3.nd.edu/~rbarger/philblfswith-epis.html [February 2015].

Baruah, N. & Ashima. 2012. A survey of the use of agile methodologies in different Indian small and medium scale enterprises (SMEs). *International Journal of Computer Applications*, 47(20):38-44.

Baskerville R., Pries-Heje J., Venable J. 2007. Soft design science research: extending the boundaries of evaluation in design science research. *2nd International Conference on Design Science Research in Information Systems & Technology (DESRIST 2007)* (CHATTERJEE S and ROSSI M Eds), Claremont Graduate University, Pasadena.

Bate, P. 2007. Editorial to the Special Issue 'Bringing the design sciences to organization development and change management'. *Journal of Applied Behavioral Science* 43(1):8–11.

Bianchi, M., Campodall'Orto, S., Frattini, F. & Vercesi, P. 2010. Enabling open innovation in small and medium-sized enterprises: How to find alternative applications for your technologies. *R&D Management*, 40 (4): 414-431.

Bianchi M., Cavaliere, A., Chiaroni, D., Frattini, F. & Chiesa, V. 2011. Organisational modes for open innovation in the bio-pharmaceutical industry: An exploratory analysis. *Technovation*, 31:22–33.

Biolchini, J., Mian, P.G. & Natali, A. 2005. *Systematic review in software engineering*. Systems Engineering and Computer Science Department, COPPE / UFRJ, Rio de Janeiro.

Boaz, A., & Ashby, D. 2003. Fit for purpose? Assessing research quality for evidence based policy and practice. London: Queen Mary University of London.

Bogers, M., Bekkers, R. & Granstrand, O. 2012. *Open innovation at firms and public administrations: Technologies for value creation. In*: Heredero, C.P. & López, D. (eds). Hershey, PA: IGI Global. 37-58.

Booth, A., Papaioannou, D. & Sutton, A. 2012. *Systematic approaches to a successful literature review.* SAGE.

Boudreau, K.J. & Lakhani, K.R. 2009. How to manage outside innovation. *MIT Sloan Management Review*, 50(4):68-76.

Brockmöller, A.A.C. 2008. *Knowledge sharing in expert-apprentice relations: Design of a protocol.* Doctoral dissertation. Groningen: Rijksuniversiteit Groningen.

Brunswicker, S. 2009. *The networked SME: Taking a closer look into open and collaborative innovation in European SMEs*. Open Innovation Speaker Series, Haas School of Business, UC Berkeley.

Brunswicker, S. 2011. *An empirical multivariate examination of the performance impact of open and collaborative innovation strategies*. Doctoral dissertation. Stuttgart: Institut für Arbeitswissenschaft und Technologiemanagement der Universität Stuttgart, Germany.

Brunswicker, S. & Ehrenmann, F. 2013. Managing open innovation in SMEs: A good practice example of a German software firm. *International Journal of Industrial Engineering and Management (IJIEM)*, 4(1):33 – 41.

Brunswicker, S. & Van de Vrande, V. 2014. Exploring open innovation in small and medium-sized enterprises. In *New frontiers in open innovation*, Henry Chesbrough, Wim Vanhaverbeke and Joel West (eds), Oxford: Oxford University Press. Chapter 7.

Brunswicker, S. & Vanhaverbeke, W. 2011. *Beyond Open Innovation in Large Enterprises: How Do Small and Medium-Sized Enterprises (SMEs) Open Up to External Innovation Sources?* [Online] Available: SSRN: http://dx.doi.org/10.2139/ssrn.1925185. [June 2016].

Brunswicker, S. & Vanhaverbeke, W. 2014. Open innovation in small and medium-sized enterprises (SMEs): External knowledge sourcing strategies and internal organizational facilitators. *Journal of Small Business Management*, 53(4):1241–1263.

Bunge, M. 1967. *Scientific Research II: The Search for Truth*. Springer Verlag, Berlin.

Carpinetti, L.C.R., Gerolamo, M.C. & Galdámez, E.V.C. 2007. Continuous innovation and performance management of SME clusters. *Creativity and Innovation Management Journal*, 16(4):376-385.

CEIN, VDC & INNONET. 2012. *Practical guide for SMEs on the management of legal issues related to open innovation*. European Collaborative and Open Regional Innovation Strategies — EURIS Program.

Chesbrough, H.W. 2003. *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.

Chesbrough, H. W. 2006. *Open business models: How to thrive in the new innovation landscape*. Boston, MA: Harvard Business School Press.

Chesbrough, H. 2010. *How smaller companies can benefit from open innovation*. Economy, Culture & History JAPAN SPOTLIGHT Bimonthly, Japan Economic Foundation.

Chesbrough, H. & Bogers, M. 2014. Explicating open innovation: Clarifying an emerging paradigm for understanding innovation. In *New frontiers in open innovation*, Henry Chesbrough, Wim Vanhaverbeke and Joel West (eds), Oxford: Oxford University Press. Chapter 4.

Chesbrough, H. & Brunswicker, S. 2013. *Managing open innovation in large firms*. Fraunhofer Verlag.

Chesbrough, H.W. & Eichenholz, J.M. 2013. Open innovation in photonics: The case for sharing and harvesting innovations in photonics. *SPIE Professional*, January 2013.

Chesbrough, H.W., Crowther, A.K. 2006. Beyond High Tech: Early adopters of open innovation in other industries. *R&D Management*, 36(3):229–236.

Chiaroni, D., Chiesa, V. & Frattini, F. 2011. The open innovation journey: How firms dynamically implement the emerging innovation management paradigm. *Technovation*, 31:34–43.

Christensen, J.F., Olesen, M.H., & Kjær, J.S. 2005. The industrial dynamics of open innovation—evidence from the transformation of consumer electronics. *Research Policy*, 34(10):1533–1549.

Clinton, L. & Whisnant. R. 2014. *20 business model innovations for sustainability*. SustainAbility Inc.

Cohen, W.M. & Levinthal, D.A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1):128–152.

Colombo, M.G., Piva, E., & Rossi-Lamastra, C. 2014. Open innovation and within-industry diversification in small and medium enterprises: The case of open source software firms. *Research Policy*, 43(5):891–902.

Cooper, R.G. 2016. Perspective: The Stage-Gate idea to launch process – update, what's new and next-gen systems. Stage-Gate International. [Online] https://www.stage-gate.net/downloads/wp/wp_30.pdf [February 2017].

Cross, N. 2001. Designerly ways of knowing: Design discipline versus design science. *Design Issues*, 17(3):49–55.

De Jong, M., Marston, N., Roth, E. & Van Biljon, P. 2013. *The eight essentials of innovation performance*. McKinsey & Company.

Denyer, D., Tranfield, D. & Van Aken, J.E. 2008. Developing design propositions through research synthesis. *Organization Studies*, 29:393-413.

De Sitter, L. U., den Hertog, J. F., & Dankbaar, B. 1997. From complex organizations with simple jobs to simple organizations with complex jobs. *Human Relations*, 50(5):497-534.

De Villiers, M.R. 2005. *Three approaches as pillars for interpretive information systems research: development research, action research and grounded theory*. In SAICSIT. White River.

Drucker, P. 1985. *Innovation and entrepreneurship: Practice and principles*. London: Heinemann.

DTI. 2015. Tools & techniques for process improvement. Department of Trade and Industry, UK. [Online] www.dti.gov.uk/quality/tools [June 2016]

Du Preez, N.D., Louw, L. 2008. A Framework for Managing the Innovation Process. In Conference Proceedings, *PICMET 2008*, Cape Town, South Africa.

Ebersberger, B., Bloch, C., Herstad, S., & Van de Velde, E. 2010. Open innovation practices and their effect on innovation performance. *International Journal of Innovation and Technology Management*, 1-22.

Ebert, J., Chandra, S. & Liedtke, A. 2008. *Innovation management strategies for success and leadership*. A.T. Kearney, Inc.

Elo, S. & Kyngäs, S.H. 2007 The qualitative content analysis process. *Journal of Advanced Nursing,* 62(1):107–115.

Enkel, E., Bell J. & Hogenkamp H. 2011. Open innovation maturity framework. *International Journal of Innovation Management*, 15(6):1161–1189.

Enkel, E. & Gassmann, O. 2010. Creative imitation: Exploring the case of cross-industry innovation. *R&D Management*, 40(3):256-270.

Erkens, M., Wosch, S., Piller, F. & Lüttgens, D. 2014. Measuring open innovation: A toolkit for successful innovation teams. *Performance*, 6(2):12-23.

Fatoki, O. & Odeyemi, A. 2010. Which new small and medium enterprises in South Africa have access to bank credit? *International Journal of Business and Management*, 5(10):128-136.

Fetterhoff, T.J. & Voelkel, D. 2006. Managing open innovation in biotechnology. *Research–Technology Management*, 49(3):14–18.

Flynn, M. & Wang, C. 2012. *A framework for open innovation*. SAP Community Network.

Fosfuri, A. 2006. The licensing dilemma: understanding the determinants of the rate of technology licensing. *Strategic Management Journal,* 27(12):1141–1158.

Foss, N.J., Laursen, K. & Pedersen, T. 2005. *Organizing to gain from user interaction: The role of organizational practices for absorptive and innovative capacities*. Copenhagen Business School.

Garibaldo, F., Hauß, I. & Mendibil, J. 2007. A reference model for excellence in innovation management. In *Open innovation for small and medium sized enterprises*, Anne Spitzley et al. (eds), Fraunhofer-Institute for Industrial Engineering.

Gassmann, O. & Enkel, E. 2004. Towards a theory of open innovation: Three core process archetypes. *Proceedings of the R&D Management Conference*. Lisbon, Portugal.

Gassmann, O., Enkel, E. & Chesbrough, H. 2010. The future of open innovation. *R&D Management*, 40 (3):213-221.

Gaule, A. 2011. The strategic context for open innovation. In *A guide to open innovation and crowd sourcing, advice from leading experts*, P Sloane (ed), pp.5-14. London: Kogan Page Limited.

Gay, B. 2014. Open innovation, networking, and business model dynamics: The two sides. *Journal of Innovation and Entrepreneurship*, 3(2):1-20.

GE, StrategyOne. 2012. *GE 2012 Global Innovation BarometerRaport*. [Online] Available: http://www.ge.com/innovationbarometer/ [January 2012].

Giannopoulou, E., Yström, A. & Ollila, S. 2011. Turning open innovation into practice: Open innovation research through the lens of managers. *International Journal of Innovation Management*, 15(3):505–524.

Golightly, J., Ford, C., Sureka, P. & Reid, B. 2012. *Realising the value of open innovation*. The Big Innovation Centre, The Work Foundation and Lancaster University.

Goldkuhl, G. 2011. Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems*, 21(2):135–146.

Goldkuhl, G. 2012. Design Research in search for a Paradigm: Pragmatism is the answer. *Communications in Computer and Information Science*, 286:84–95.

Gous J.H. 2014. *Towards a reference architecture for integrated knowledge networks*. PhD dissertation. Stellenbosch: University of Stellenbosch, South Africa.

Hatchuel, A., & Weil, B. 2009. CK design theory: An advanced formulation. *Research in Engineering Design*, 19(4):181-192.

Hemert, P., Nijkamp, P., & Masurel, E. 2013. From innovation to commercialization through networks and agglomerations: analysis of sources of innovation, innovation capabilities and performance of Dutch SMEs. *The Annals of Regional Science*, 50(2):425–452.

Hevner, A.R. 2007. A Three Cycle View of Design Science Research. *Scandinavian Journal of Information Systems*, 19(2):87–92.

Hevner, A.R., March, S.T., Park, J., & Ram, S. 2004. Design science in information systems research. *MIS quarterly*, 28(1):75–105.

Hevner, A.R. 2012. Design Science Research Workshop.

Holloway, S.S., van Eijnatten, F.M., Romme, A.G.L., Demerouti. E. 2015. Developing actionable knowledge on value crafting: A design science approach. Forthcoming in: *Journal of Business Research*.

Hossain, M. 2015. A review of literature on open innovation in small and medium-sized enterprises. *Journal of Global Entrepreneurship Research*, 5(1).

Hughes, A. 2009. Innovation and SMEs: Hunting the Snark: Some reflections on the UK experience of support for the small business sector. *Innovation: Management, Policy & Practice*, 11(1):114–126.

Huizingh, E.K.R.E. 2011. Open innovation: State of the art and future perspectives. *Technovation*, 31:2–9.

Igartua, J.I., Garrigós, J.A. & Hervas-Oliver, J.L. 2010. How innovation management techniques support an open innovation strategy. *Research — Technology Management*, May–June:41-52.

Iivari, J. 2007. A paradigmatic analysis of information systems as a design science. *Scandinavian Journal of Information Systems*, 19(2):39-64.

IMP3rove Academy. 2012. How to Deal with Innovation Management When You Are Small?

InnovationManagement.SE. [Online] Available: http://bit.ly/1ooN9XO [October 2014].

Innovation Management. 2012. *How to deal with innovation management when you are small?* [Online] Available: http://www.innovationmanagement.se/2012/12/19/how-to-deal-with-innovation-management-when-you-are-small/. [October 2013].

International Institute for Sustainable Development. 2004. *Issue briefing note: Small and medium-sized enterprises*.

Jin, E.M., Girvan, M. & Newman, M.E.J. 2001. The structure of growing social networks. *Physical Review E, 64(4).*

Karlsson, M. 2010. *Collaborative idea management: Using the creativity of crowds to drive innovation*. Applied Innovation Management, #1, InnovationManagement.SE.

Katz, B. 2006. *The Integration of Project Management Processes with a Methodology to Manage a Radical Innovation Project*. Master's Thesis in Industrial Engineering. Stellenbosch: Stellenbosch University.

Keupp, M.M., & Gassmann, O. 2007. The competitive advantage of early and rapidly internationalising SMEs in the biotechnology industry: a knowledge based view. *Journal of World Business*, Special Issue: The Early and Rapid Internationalisation of the Firm, 42(3):350–366.

Khan, K.S., Kunz R., Kleijnen, J. & Antes, G. 2003. Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, 96:118–121.

Kirchgeorg, V., Achtert, M. & Großeschmidt, H. 2010. *Pathways to innovation excellence: Results of a global study by Arthur D. Little*. Arthur D. Little.

Kossiakoff A., Sweet W.N., Seymour S.J., Biemer S.M. 2011. *Systems engineering principles and practice* second edition. John Wiley & Sons, Inc., Hoboken, New Jersey.

Krause, W. & Schutte, C.S.L. 2015. A perspective on open innovation in South African small and medium sized enterprises and design requirements for an open innovation approach. *South African Journal of Industrial Engineering*, 26(1):163-178.

Krause, W. & Schutte, C.S.L. 2015. A framework towards an open innovation approach for SMEs. *Conference Proceedings, International Association for Management of Technology IAMOT 2015, Cape Town, South Africa*.

Krause, W. & Schutte, C.S.L. 2016. Developing design propositions for an open innovation approach for SMEs. *South African Journal of Industrial Engineering,* 27(3) Special Edition:37-49.

Krause, W., Schutte, C.S.L. & Du Preez, N. 2012. An exploratory study on preferred open innovation types and partners in South African SMEs. *Conference Proceedings, Industrial Engineering and Engineering Management Conference, Hong Kong*.

Krause, W., Schutte, C.S.L. & Du Preez, N. 2012. Open innovation in South African small and medium-sized enterprises. *CIE42 Conference Proceedings, Cape Town, South Africa*.

Kuechler, B. & Vaishnavi, V. 2011. Extending prior research with design science research: two patterns for DSRIS project generation. *In Service-Oriented Perspectives in Design Science Research*. Springer: 166–175.

Laursen, K., & Salter, A. 2006. Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27(2):131–150.

Lee, S., Park, G., Yoon, B. & Park, J. 2010. Open innovation in SMEs: An intermediated network model. *Research Policy*, 39(2010):290–300.

Lichtenthaler, U. 2008. Open innovation in practice: an analysis of strategic approaches to technology transactions. *Engineering Management, IEEE Transactions*, 55(1):148–157.

Lichtenthaler, U. & Lichtenthaler, E. 2009. A capability-based framework for open innovation: Complementing absorptive capacity. *Journal of Management Studies*, 46(8):1315–1338.

Lindegaard, S. 2010. *The Open Innovation Revolution*. John Wiley & Sons, Inc., Hoboken, New Jersey.

Lindegaard, S. 2011. *Making open innovation work*. CreateSpace, North Charleston, SC.

Loren, K.L. 2011. What Is Open Innovation? In *A guide to open innovation and crowd sourcing, advice from leading experts*, P Sloane (ed), pp.5-14. London: Kogan Page Limited.

MacKinven, S., MacBryde, J. & Wagner, B. 2014. Sensing opportunities: Is there a need for a managed search process in open innovation? *Conference Proceedings, 21st EurOMA Conference*. Palermo, Italy.

Manceau, D., Moatti, V., Fabbri, J., Kaltenbach, P. & Bagger-Hansen, L. 2011. *Open innovation — What is behind the buzzword?* ESCP Europe & Accenture.

Marais, S. 2010. *The definition and development of Open Innovation models to assist the innovation process*. Master's Thesis. Stellenbosch: Stellenbosch University, South Africa.

Mattes, F. 2011. How to make open innovation work for your R&D. *Applied Innovation Management*, #3, InnovationManagement.SE.

Mattes, F. 2012. *Moving from open innovation to true open innovation*. InnovationManagement.SE [Online] Available: http://www.innovationmanagement.se/2012/10/ 08/ moving-from-open-innovation-to-true-open-innovation/. [February 2015].

Mehlman, S.K., Uribe-Saucedo, S., Taylor, R.P., Slowinski, G., Carreras, E. & Arena, A. 2010. Better practices for managing intellectual assets in collaborations. *Research-Technology Management*, 53(1):55-66.

MED. 2012. *Hidden innovation initiatives for SMEs*. BIC, MED and European Union Development Fund.

Mey, G. & Mruck, K. 2009. *Methodologie und Methodik der Grounded Theory*. In: Kempf, Wilhelm/Kiefer, Markus (eds): Forschungsmethoden der Psychologie. Zwischen naturwissenschaftlichem Experiment und sozialwissenschaftlicher Hermeneutik. Band 3. Berlin: Regener, pp. 100–152.

Minderhoud, S. 2012. Balancing the nine power questions of innovation excellence. *Conference Proceedings, ISPIM. 2012.* Barcelona, Spain.

Moen, R., Norman C. 2006. Evolution of the PDSA cycle.

Moen, R. & Norman, C. 2010. Circling back: Clearing up the myths about the Deming cycle and seeing how it keeps evolving. *Qual Progress*, 42:23–8.

Mortara, L., Napp, J.J., Slacik, I. & Minshall, T. 2009. *How to implement open innovation: Lessons from studying large multinational companies*. University of Cambridge.

Mortara, L. 2010. *Getting help with open innovation*. Centre of Technology Management, University of Cambridge Institute for Manufacturing.

Nada, N. 2010. A framework for systematic application and measurement of the innovation management process. *The Journal of Knowledge Economy & Knowledge Management*, V (Fall):57–69.

National Small Business Act. 1996. No. 102, 1996, amended by act 29 of 2004. Office of the Presidency, South African Government.

Newey, L. 2010. Wearing different hats: how absorptive capacity differs in open innovation. *International Journal of Innovation Management*. 14(4):703–731.

NineSigma, 2011. *Open Innovation Scorecard Survey Report.* [Online] Available: http://www.ninesigma.com/Uploads/Resources/NineSigma%202011%20OI%20Scorecard%20Report.pdf [March 2012].

Nonaka, I., Konno, N. & Toyama, R. 2001. Emergence of 'BA'. In *Knowledge emergence: Social, technical, and evolutionary dimensions of knowledge creation*, Ikujirō Nonaka and Toshihiro Nishiguchi (eds), Oxford University Press:13-29.

OECD. 2008. *Open innovation in global networks*. Organisation for Economic Co-Operation and Development, Policy Brief, November.

Offermann, P., Levina, O., Schönherr, M. & Bub, U. 2009. Outline of a Design Science Research Process. *Conference Proceedings DESRIST'09, Malvern, PA, USA*.

Open Innovation Toolkit. [Online] Available: http://www.toolkit.100open.com/ [August 2016].

OPINET. 2011. *Open innovation: Benefits for SMEs*. European Collaborative and Open Regional Innovation Strategies — EURIS Program.

OPINET. 2011. *Open innovation: Open innovation best practice guide*. European Collaborative and Open Regional Innovation Strategies — EURIS Program.

O'Sheedy, D. & Sankaran, S. 2013. Agile project management for IT Projects in SMEs: A framework and success factors. *The International Technology Management Review*, 3(3):187-195.

Osterwalder, A., et. al. 2009. *Business model design and innovation*. [Online] Available: http://business-model-design.blogspot.com/[April 2011].

Page, C. & Meyer, D. 2000. *Applied Research Design for Business and Management*. Irwin/McGraw-Hill. North Ryde Australia.

Parida, V., Westerberg, M., & Frishammar, J. 2012. Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. *Journal of Small Business Management*, 50(2):283–309.

Pawson, R. 2006. *Evidence Based Policy: A Realist Perspective*. London: Sage.

Pawson, R. and Tilly, N. 1997. *Realistic Evaluation*. Sage, London.

Peffers, K., Tuunanen, T., Rothenberger, M.A., & Chatterjee, S. 2008. A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, 24(3):45–77.

Peffers, K., Rothenberger, M.A., Tuunanen, T., Vaezi, R. 2012. Design Science Research Evaluation. In *Design Science Research in Information Systems*. *Advances in Theory and Practice*. Lecture Notes in Computer Science. Berlin, Heidelberg: Springer Berlin Heidelberg: 398–410.

Peters, I. 2014. *Too Abstract to Be Feasible? Applying the Grounded Theory Method in Social Movement Research*. GIGA Working Papers 247. GIGA German Institute of Global and Area Studies.

Pfeffer, J. 1997. *New Directions in Organization Theory*. Oxford University Press: New York.

Phillips, J. 2011. Open innovation technology. In *A guide to open innovation and crowd sourcing: Advice from leading experts,* Paul Sloane (ed.), London: Kogan Page Limited. Chapter 3.

Piller, F. & West, J. 2014. Firms, users, and innovation: An interactive model of coupled open innovation. In *New frontiers in open innovation*, Henry Chesbrough, Wim Vanhaverbeke and Joel West (eds), Oxford: Oxford University Press. Chapter 2.

Project Management Institute. 2008. *A guide to the project management body of knowledge (PMBOK Guide), Fourth Edition*. PMI, Inc, Pennsylvania, USA.

Project Management Institute. 2013. *Managing change in an organisation: A practice guide*. [Online] Available: on http://www.pmi.org/learning/change-management.aspx. [February 2016].

Ragunath, P.K., Velmourougan, S., Davachelvan, P., Kayalvizhi, S., Ravimohan, R. 2010. Evolving a New Model (SDLC Model-2010) for Software Development Life Cycle (SDLC). IJCSNS *International Journal of Computer Science and Network Security*, 10(1):112-119.

Rahman, H., Ramos, I. 2010. *Open Innovation in SMEs: From Closed Boundaries to Networked Paradigm*. Issues in Informing Science and Information Technology, 7.

Rhodes, D.L. 2012. *The Systems Development Life Cycle (SDLC) as a Standard: Beyond the Documentation*. U.S. Census Bureau, Washington D.C., Paper 194-2012, SAS Global Forum.

Ries, E. 2011. *The lean startup: How constant innovation creates radically successful businesses*. Portfolio Penguin.

Robu, M. 2013. The dynamic and importance of SMEs in economy. *The USV Annals of Economics and Public Administration*. 13(1)(17).

Romme, A.G.L. 2003. Making a difference: Organization as Design. *Organization Science*, 14 (5):558-73.

Royce, W.R. 1970. Managing the development of large software systems. *Proceedings, IEEE, WESCON*.328 – 338.

Shukla, A. 2009. *What is Innovation? Why Innovation is important?* Getting Into Roots. [Online] Available: http://www.paggu.com/getting-into-roots/what-is-innovation-why-innovation-isimportant/ [March 2011].

Schutte, C.S.L. & Du Preez, N. 2010. A comparative study about the formal design life cycle of the integrated knowledge network to support innovation. *Conference Proceedings, International Conference on Competitive Manufacturing — COMA 2010, Stellenbosch, South Africa.*

Silberzahn, P., Van Dyck, W. 2010. *The Benefits of Open Innovation in Low-Tech SMEs: The Quilts of Denmark Story*. InnovationManagement, November.

Simon, H.A. 1996. *The Sciences of the Artificial* 3rd ed., MIT Press.

South African Government. 2011. *National Council Of Provinces (NCOP) Budget Vote Speech*. [Online] Available: http://www.info.gov.za/speech/DynamicAction?pageid=461&sid=19563&tid=36210 [January 2012].

Slowinski, G. & Sagal, M.W. 2010. Good practices in open innovation. *Research-Technology Management*, 53(5):38-45.

Sloane, P. (Ed.). 2011. *A Guide to Open Innovation and Crowdsourcing: Advice From Leading Experts*. London: Kogan Page.

Spithoven, A., Clarysse, B., & Knockaert, M. 2011. Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation*, 31(1):10–21.

Spithoven, A., Teirlinck, P., and Frantzen, D. 2012. *Managing Open Innovation: Connecting the Firm to External Knowledge*. Cheltenham: Edward Elgar.

Spithoven, A., Vanhaverbeke, W., & Roijakkers, N. 2013. Open innovation practices in SMEs and large enterprises. *Small Business Economics*, 41(3):537–562.

Spitzley, A. & Schweinfort, W. 2007. *Better and faster — Innovation as success story,* in *Open Innovation for small and medium sized enterprises*, Anne Spitzley et al. (eds), Fraunhofer-Institute for Industrial Engineering.

Strauss, Anselm L. 1998. *Grundlagen qualitativer Sozialforschung*. 2nd edition. München: Wilhelm Fink Verlag.

Tan, W.L. 2010. *SMEs and international partner search*. Doctoral dissertation. Eindhoven: Eindhoven University of Technology.

Taylor, M.J., McNicholas, C., Nicolay, C., Darzi, A., Bell, D. & Reed, J.E. 2013. *Systematic Review of the Application of the Plan–Do–Study–Act Method to Improve Quality in Healthcare*. BMJ Qual Saf Published Online First: [11 September 2013] doi:10.1136/bmjqs-2013-001862.

Terziovski, M. 2010. Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: A resource-based view. *Strategic Management Journal*, 31(8):892-902.

Theyel N. 2013. Extending open innovation throughout the value chain by small and medium-sized manufacturers. *International Small Business Journal*, 31(3):256–274.

The business model canvas. [Online] Available: *https://strategyzer.com/canvas* [February 2016].

Tomlinson, P. R. 2010. Co-Operative Ties and Innovation: Some New Evidence for UK Manufacturing, *Research Policy*, 39(6):762–775.

Tranekjer, T.L., & Søndergaard, H.A. 2013. Sources of innovation, their combinations and strengths–benefits at the NPD project level. *International Journal of Technology Management*, 61(3):205–236.

Tranfield, D., Denyer, D., & Smart, P. 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14:207–222.

Turner R., Ledwith, A. & Kelly J. 2012. Project management in small to medium-sized enterprises: Tailoring the practices to the size of company. *Management Decision*, 50(5):942-957.

Tushman, M. & O'Reilly III, C. 2007. Research and relevance: Implications of Pasteur's quadrant for doctoral programs and faculty development. *Academy of Management Journal*, 50(4):769-774.

Tutorialspoint. 2014. Software Development Life Cycle. Online: http://www.tutorialspoint.com/sdlc/.

Vahter, P., Love, J.H. & Roper, S. 2012. *Openness and innovation performance: Are small firms different?* Working Paper No. 113. Warwick Business School, University of Warwick.

Vaishnavi, V. & Kuechler, B. 2004. Design Science Research in Information Systems. desrist.org. [Online] Available: http://desrist.org/design-research-in-information-systems/ [September 2013].

Van Aken, J.E. 2004. Management research based on the paradigm of the design science: The quest for field-tested and grounded technological rules. *Journal of Management Studies*, 41(2):219-46.

Van Aken, J.E. 2005. Management research as a design science: Articulating the research products of mode 2 knowledge production in management. *British Journal of Management*, 16:19-36.

Van Aken, J.E. 2007. Design science and organizational development interventions: Aligning business and humanistic values. *Journal of Applied Behavioral Science*, 43(1):67-88.

Van Aken, J.E. 2013. Design science: Valid knowledge for socio-technical system design. *Communications in Computer and Information Science*, 388:1-13.

Van Aken, J. E., Berends, H. & Van der Bij, H. 2007. *Problem solving in organizations*. Cambridge: Cambridge University Press.

Van de Vrande, V., De Jong, J.P., Vanhaverbeke, W., & De Rochemont, M. 2009. Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6):423–437.

Van de Vrande, V., De Jong, J.P.J., Vanhaverbeke, W. & De Rochemont, M. 2008. *Open innovation in SMEs: Trends, motives and management challenge*. Scientific Analysis of Entrepreneurship and SMEs (SCALES).

Van Dyk, L. 2013. The Development of a Telemedicine Service Maturity Model. PhD Dissertation. Stellenbosch: Stellenbosch University, South Africa.

Vanhaverbeke, W. 2012. *Open innovation in SMEs: How can small companies and start-ups benefit from open innovation strategies?* Flanders DC and Vlerick Leuven Gent Management School.

Vanhaverbeke, W. 2013. Rethinking open innovation beyond the innovation funnel. *Technology Innovation Management Review*, April:6-10.

Vanhaverbeke, W., Duysters, G. & Noorderhaven, N. 2002. External technology sourcing through alliances or acquisitions: An analysis of the application-specific integrated circuits industry. *Organization Science*, 13:714-733.

Vanhaverbeke, W., Vermeersch, I. & De Zutte, S. 2012. *Open innovation in SMEs: How can small companies and start-ups benefit from open innovation strategies?* Flanders DC Knowledge Centre.

Van Staveren, M.T. 2009. *Design propositions for implementing risk management in organizations*. Doctoral dissertation. Groningen: University of Twente, The Netherlands.

Vega-Vazquez, M., Revilla-Camacho, M.A., Cossio-Silva, F.J. 2013. The value co-creation process as a determinant of customer satisfaction. *Management Decision*, 51(10):1945-1953.

Venable, J., Pries-Heje, J. & Baskerville, R. 2012. A Comprehensive Framework for Evaluation in Design Science Research. In *Design Science Research in Information Systems. Advances in Theory and Practice*. Springer Berlin Heidelberg:423–438.

Venable, J., Pries-Heje, J. & Baskerville, R. 2014. FEDS: A Framework for Evaluation in Design Science Research. *European Journal of Information Systems*,1–13.

Von Hippel, E. 2005. Democratizing innovation, The MIT Press.

Von Oertzen, J. 2006. *Grounded Theory*. In: Behnke, Joachim/Gschwend, Thomas/ Schindler, Delia/Schnapp, Kai-Uwe (eds): Methoden der Politikwissenschaft. Neuere qualitative und quantitative Analyseverfahren. Baden-Baden: Nomos, pp. 145–154.

Wagner, P. & Piller, F. 2012. Are you ready for open innovation processes? *Performance*, 4(2):22-31.

Wang, L., et. al. 2009. Developing a Conceptual Framework for Business Model Innovation in the Context of Open Innovation. *3rd IEEE International Conference on Digital Ecosystems and Technologies, Istanbul, France*.

Weber, M. 2011. *Customer co-creation in innovations: A protocol for innovating with end users*. Doctoral thesis. Eindhoven: Technische Universiteit Eindhoven.

West, J. & Bogers, M. 2014. Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management*, 31(4):814-831.

Wright, H. 2007. *Ten Steps To Innovation Heaven*. Marshall Cavendish Limited, London.

Zeng, S.X., Xie, X.M., & Tam, C.M. 2010. Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, 30(3):181–194.

Ziltener A. & Wagner K. 2008. *Fostering Innovation Activities of SMEs with Regional Innovation Centres*. Institute for Small Business & Entrepreneurship. Belfast, N. Ireland.

Appendix A Full Open Innovation Survey Results

108 responses were received, of which 85 responses could be used after applying the criteria of respondents having to be South African SMEs. This provided a qualified response rate of 15.9 percent for the survey.

TABLE A- 1: RESPONSE RATE

Survey Indicator	Count	Percentage
Total invites	534*	100%
Total responses	108	20.2%
Total qualified responses	85**	15.9%

* Including 3 participants from pilot

** Filtering for responses indicating South African SMEs only

Thirty three percent of the responses received were from IT-related SMEs. The results will be reported in this chapter, showing all the responses combined as well as the split between IT and non-IT responses. This should highlight any skewness in the overall results due to the high IT industry response rate and contrast any differences between IT and non-IT SMEs. The response percentages are indicated showing All, Non-IT, and IT by the following notation {All%;Non-IT%;IT%} when discussed and not shown in table format.

A.1 Demographics and Characteristics

The highest number of responses was received from SMEs in Gauteng {52.9; 50.9; 57.1}, which could have been expected since Gauteng received the highest number of survey invites. Gauteng also contributed the highest percentage to South Africa's GDP, so it is fitting that it dominated the responses. The second-highest response rate was received from the Western Cape {36.5; 36.8; 35.7}.

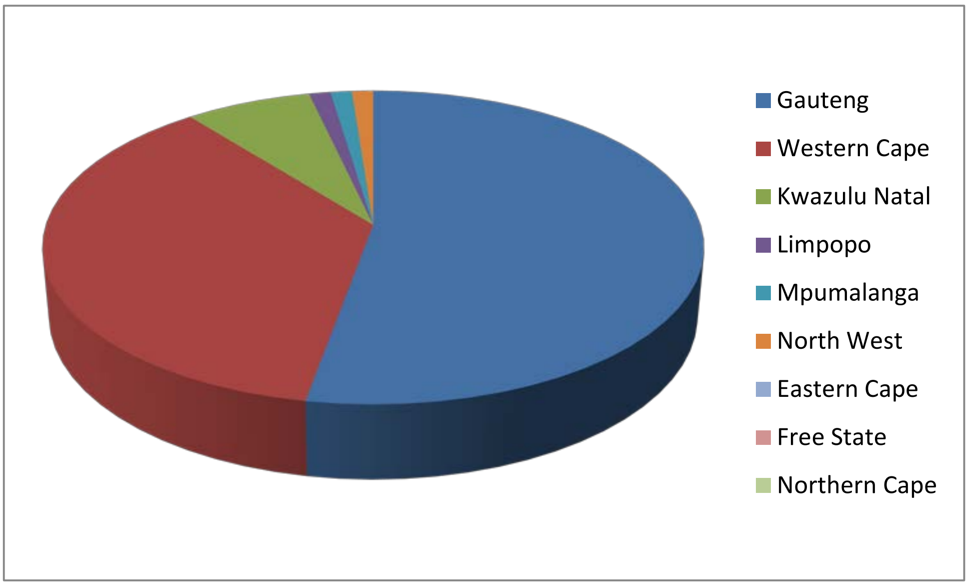


FIGURE A-1: PROVINCES

Most SMEs had between 1 and 10 employees in their organisations, but IT-related SMEs showed higher employee counts.

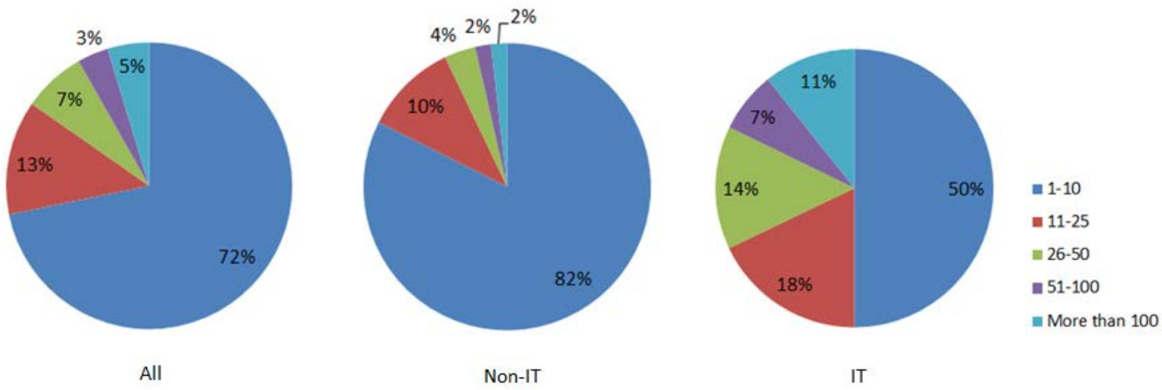


FIGURE A-2: NUMBER OF EMPLOYEES

Responses were received from 14 different industries, with Information Technology (32.9%), Educational Services (11.8%), Professional, Scientific and Technical Services (10.6%), Management of Companies and Enterprises (10.6%), Retail and Wholesale Trade (5.9%) and Arts, Entertainment and Recreation (5.9%) representing the top six industry categories.

Respondents were mostly owners of the organisations, which should aid in the accuracy of the responses relating to their organisations.

TABLE A- 2: ORGANISATIONAL ROLE

Organisational Role	All	Non-IT	IT
Owner	76.5%	84.2%	60.7%
Manager	15.3%	12.3%	21.4%
Specialist	8.2%	3.5%	17.9%

A very interesting statistic from the survey was the number of years the SMEs had been in operation. More than 75 percent of the organisations had been in operation for more than three years with over 28 percent having been in operation for more than 10 years. These were well-established organisations.

TABLE A- 3: YEARS IN OPERATION

Years in Operation	All	Non-IT	IT
Less than 1	7.1%	10.5%	0.0%
1 to 2	14.1%	10.5%	21.4%
3 to 5	28.2%	29.8%	25.0%
6 to 10	22.4%	21.1%	25.0%
More than 10	28.2%	28.1%	28.6%

A.2 Innovation

The survey participants were first asked about innovation in general, to establish their innovation activity and views. The following definitions of innovation were provided to survey participants at the beginning of this section to ensure that everyone had the same understanding of what was meant by 'innovation':

The definitions for innovation that were provided are:

- The process of improving an existing product or service.
- The process that translates knowledge into economic growth and social well-being. It encompasses a series of scientific, technological, organisational, financial and commercial activities.
- Exploiting new ideas leading to the creation of a new product, process or service.
- Creating value out of new ideas, new products, new services or new ways of doing things.
- The successful generation, development and implementation of new and novel ideas.

Most respondents classified their organisations to be innovative, with overall more than 87 percent agreeing either strongly or slightly to this question and no one disagreeing strongly. It would therefore suggest that innovation is important to these organisations.

TABLE A- 4: INNOVATIVE RATING

Your Organisation is Innovative	All	Non-IT	IT
Agree Strongly	61.2%	57.9%	67.9%
Agree Slightly	25.9%	29.8%	17.9%
Neither agree nor disagree	7.1%	7.0%	7.1%
Disagree slightly	5.9%	5.3%	7.1%
Disagree strongly	0.0%	0.0%	0.0%

Considering the next question however, it seems that innovation is funded on an ad hoc basis with only 18.8 percent of overall respondents indicating that they had a separate budget line item for innovation. IT organisations showed a higher maturity in this category with a much higher percentage of 32 percent stating that they have a separate innovation budget compared to the 12 percent of non-IT respondents.

TABLE A- 5: INNOVATION BUDGET

Separate budget	All	Non-IT	IT
Yes	18.8%	12.3%	32.1%
No	81.2%	87.7%	67.9%

For SMEs, innovation does not seem to be a formalised process instilled in their organisations, with only 27.1 percent overall indicating that a formal innovation process existed, whereas the IT SMEs again had a higher rate of 42.9 percent compared with the 19.3 percent of Non-IT organisations.

It is interesting to note that despite the lack of formal innovation processes or dedicated innovation budgets, the SMEs still reported a high level of innovation activity. Only about 10 percent of respondents indicated that they had not produced a new innovation during the 12 months prior to the survey. The question however only measures how many new innovations were launched into the market or internally and does not provide a view of the size, complexity, success or value of the innovation.

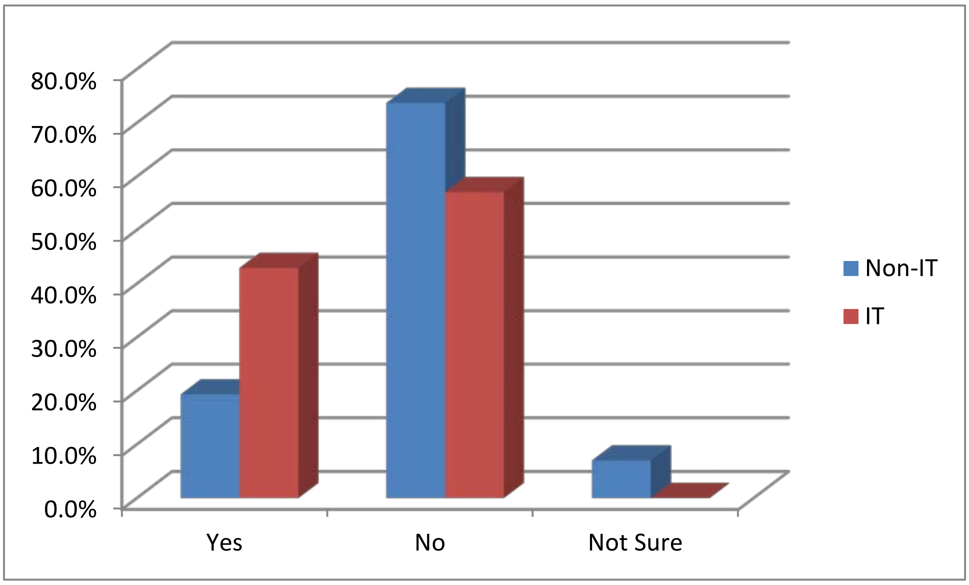


FIGURE A-3: FORMAL INNOVATION PROCESS

TABLE A- 6: INNOVATION DEPLOYED LAST 12 MONTHS

New innovations deployed into the market or implemented in-house in the last 12 months	All	Non-IT	IT
None	10.6%	10.5%	10.7%
1-3	63.5%	59.6%	71.4%
4-10	18.8%	21.1%	14.3%
More than 10	7.1%	8.8%	3.6%

Respondents were asked what types of innovation they had done in the year prior to the survey. Most popular was product innovation for both the IT and Non-IT SME groups. Business model and Strategy also received a lot of attention, with Process and Marketing coming out average.

Organisations indicated that the trend to focus on Product innovation will remain for the next year {63.5; 59.6; 71.4}, but that there will also be more emphasis on Brand and Marketing innovation {50.6; 54.4: 42.9}. Planned innovation within Market and Channel {42.4; 43.9; 39.3}, Service {41.2; 43.9; 35.7} and Customer Experience {40.0; 38.6; 42.9} sectors also scored high.

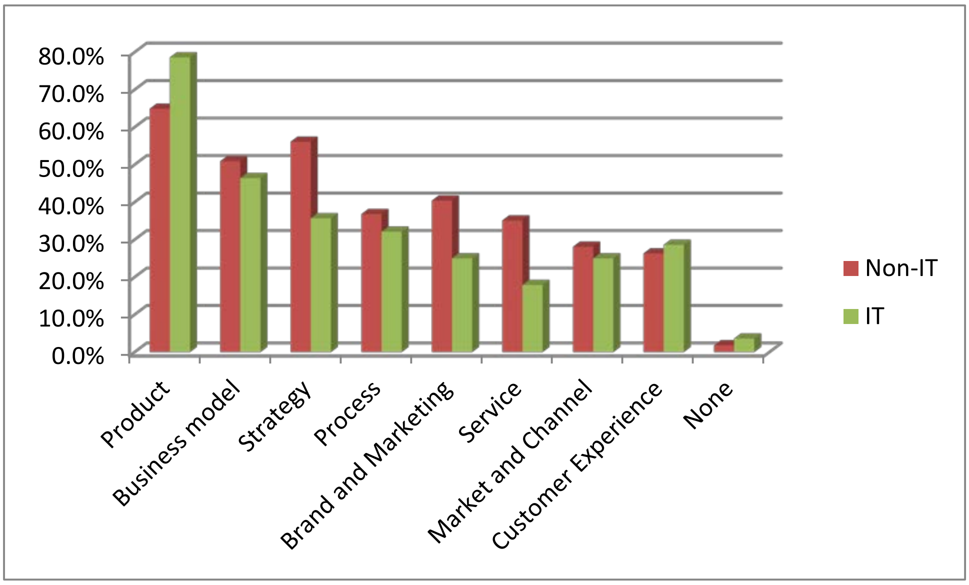


FIGURE A-4: INNOVATION FOCUS PREVIOUS YEAR

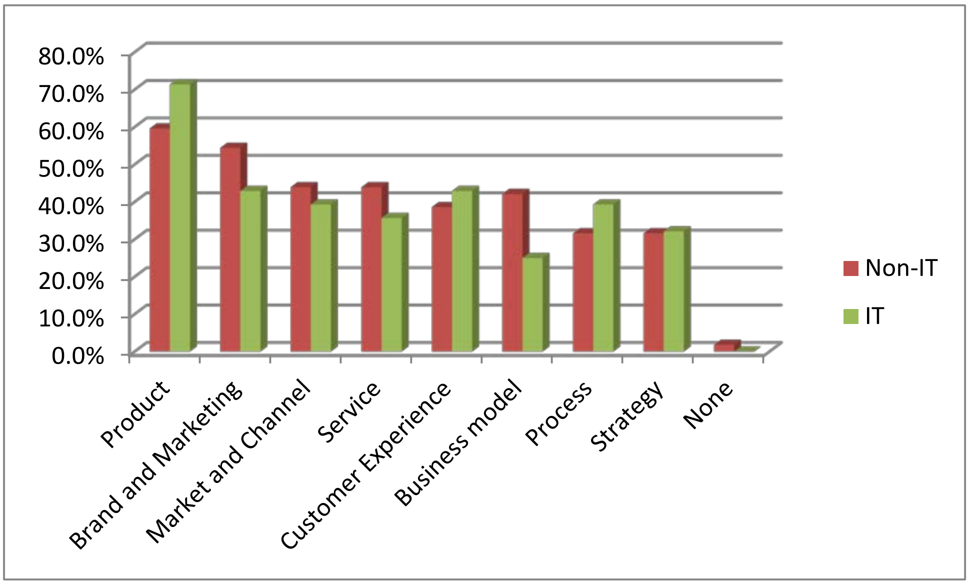


FIGURE A-5: INNOVATION FOCUS COMING YEAR

Organisations rated their own innovation output compared to other organisations in their industry as higher than average, indicating more innovation output {54.1;54.4;53.6} or similar innovation output {22.4;22.8;21.4} respectively.

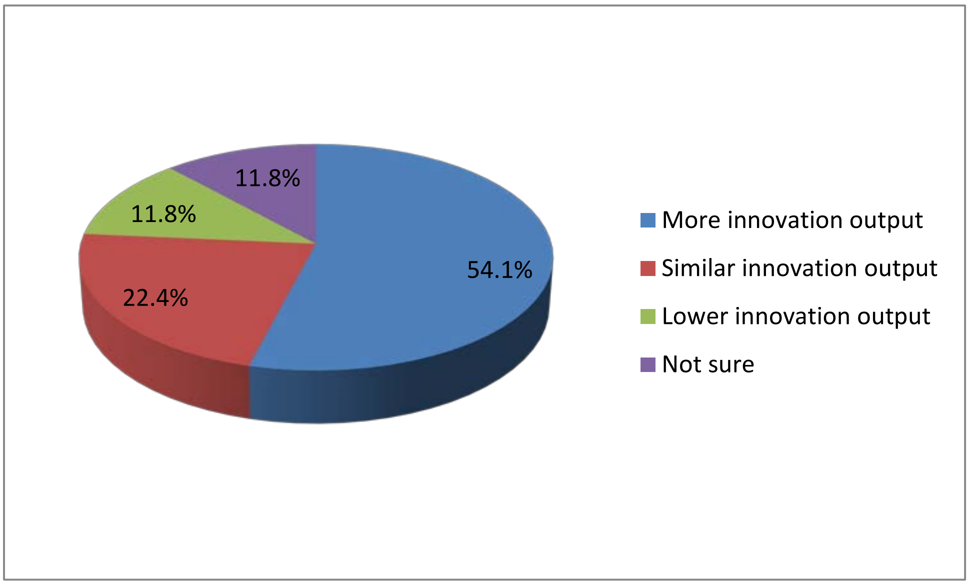


FIGURE A-6: EXPECTED INNOVATION OUTPUT

Organisations also mostly indicated that they consider innovation to be important for success in their respective industries with over 80 percent agreeing strongly to that statement. The majority of the organisations saw a need to innovate continuously and to innovate well.

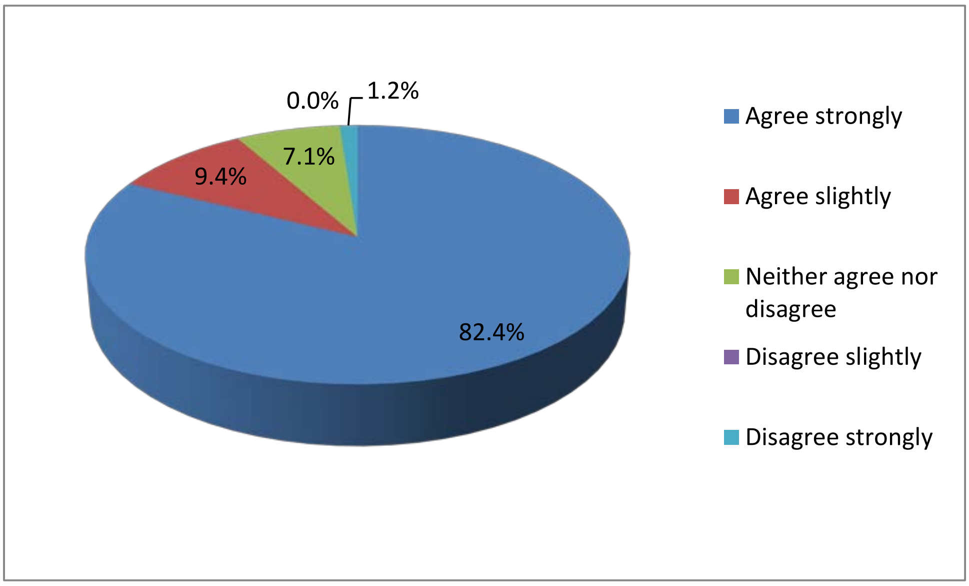


FIGURE A-7: INNOVATION IMPORTANCE

In 2012 GE conducted an innovation study of large organisations in their Global Innovation Barometer survey (GE, 2012). The survey showed that 85 percent of South African organisations agreed with the statement that, more than ever before, SMEs and individuals can be as innovative as large companies. The same question was asked in this survey and 81.2 percent of respondents agreed with the statement, with IT-orientated SMEs being the most optimistic at 85.7 percent. It indicates a very positive attitude towards innovation and being able to compete against larger organisations to bring new products and services to the market.

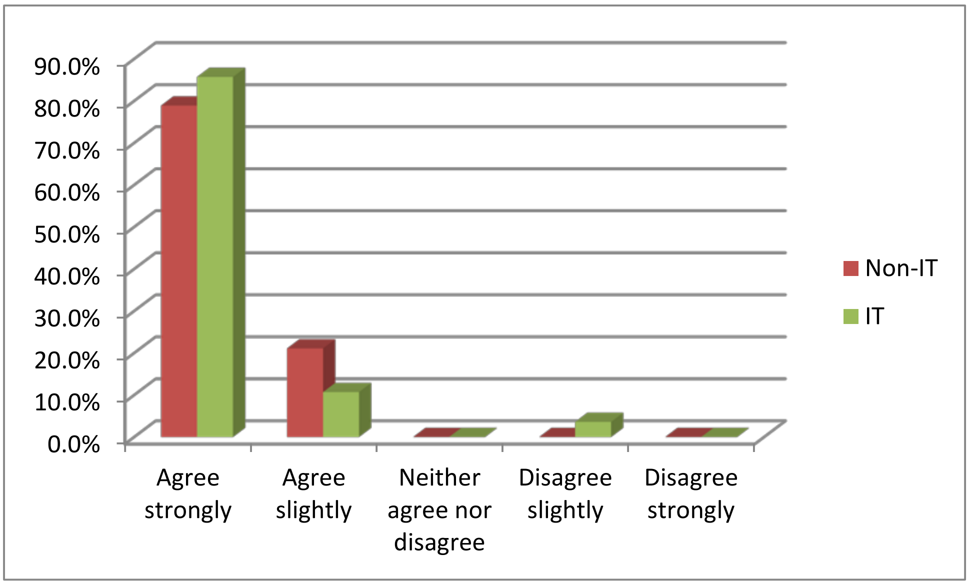


FIGURE A-8: SMES AS INNOVATIVE AS LARGE ORGANISATIONS

A.3 Open Innovation

The next section will cover the survey questions relating to open innovation specifically. In the beginning of the open innovation section in the survey, the following description was provided to participants to position the term:

Open innovation can be described as "a two-way process in which companies have an inbound process in which they bring in ideas, technologies, or other resources needed to develop their own business and an outbound process in which they out-license or sell their own ideas, technologies, and other resources". The open innovation process does not rely only on the organisation's own knowledge to innovate, but incorporates knowledge and skills and technology from outside of the organisation to innovate.

Respondents did not consider themselves to be experts in their knowledge of open innovation with only 17.6 percent agreeing strongly that they considered themselves knowledgeable on the topic. It shows that there is indeed a need to educate SMEs more on open innovation and formalise the concept more. The results were similar when extending the question to the understanding of open innovation within the organisation. About a quarter of respondents thought that their organisation's knowledge of open innovation was fairly low.

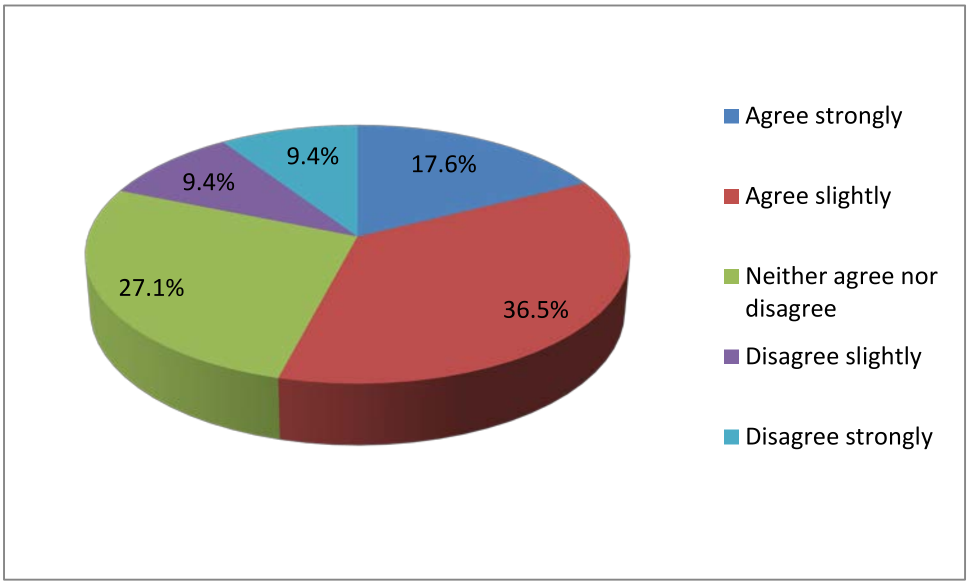


FIGURE A-9: RESPONDENTS CONSIDERING THEMSELVES TO HAVE GOOD KNOWLEDGE OF OPEN INNOVATION

TABLE A- 7: ORGANISATIONAL KNOWLEDGE OF OPEN INNOVATION

Our Organisation is knowledgeable about Open Innovation	All	Non-IT	IT
Agree Strongly	17.6%	15.8%	21.4%
Agree Slightly	32.9%	38.6%	21.4%
Neither agree nor disagree	23.5%	17.5%	35.7%
Disagree slightly	12.9%	12.3%	14.3%
Disagree strongly	12.9%	15.8%	7.1%

Just over 60 percent of all respondents indicated that they are involved in some sort of open innovation activity in their organisations, either rolling it out, optimising it or relaunching their open innovation programmes. This was somewhat surprising considering the confidence level of participants regarding open innovation knowledge not being very high. It was positive to see the percentage of organisations which were optimising an ongoing open innovation programme. This might explain the confidence levels in their understanding of open innovation, showing that it is a learning process for these organisations where they still need to mature their capability.

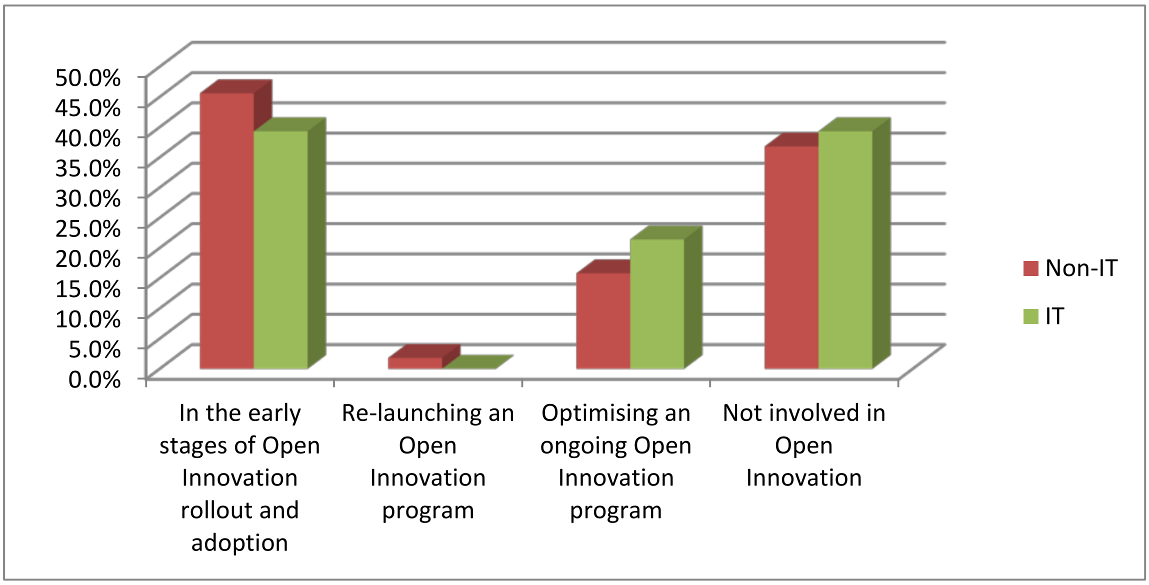


FIGURE A-10: INVOLVEMENT IN OPEN INNOVATION

The question about understanding where SMEs are on their open innovation journey was taken from the 2011 Open Innovation Scorecard Survey Report by NineSigma (2011). It is interesting to note that the responses in the South African survey compared closely to the responses provided by Middle Market Companies (US$250 million–US$1 billion in Revenue) in the NineSigma report, scoring 42 percent, 4 percent, 17 percent and 37 percent respectively for the above options in their study.

The literature describes various open innovation types. For the survey study, the main types were extracted to provide the following descriptions to the respondents before asking questions regarding open innovation types:

Platforming: Providing a base product to which consumers can extend the capabilities of the product and add value to all involved (such as iPad and Apple store applications).

Idea Competitions/Challenges: Rewarding individuals, groups or companies for providing ideas to solve specific stated problems in the form of a competition or challenge.

Customer Immersion: Observation of the customer-product interaction process to further enhance products or services.

Collaboration: Developing new products, services or other capabilities through collaborating with customers, suppliers, or other third parties.

Innovation Networks: Incorporating the input from a network of contributors such as innovation hubs, advisory boards and science centres.

Innovation Intermediaries: A company which focuses its business on helping other companies implement various facets of open innovation.

IP or Tech In-licensing or Acquisition: Licensing or buying patents and technology and incorporating them into your organisation.

IP or Tech Out-licensing or Selling: Licensing or selling your own patents and technology to other organisations or spinning out a new company.

Lead Users: Identifying innovations added to your product by users for their own use and then incorporating the ideas back into your product.

The survey results showed that Collaboration was the preferred open innovation type with more than 57 percent of the SMEs indicating that they have used that as an innovation method over the past 18 months. Customer Immersion, Platforming, Idea Competitions and tapping into Innovation Networks also proved popular. The least-favourite method opted for was IP or Tech In-licensing or Acquisition, with less than 10 percent of the participants indicating that they have used this in the last year, even under IT organisations. This shows a huge potential opportunity for organisations to explore this method of open innovation within South Africa.

TABLE A- 8: OPEN INNOVATION TYPES LAST 18 MONTHS

Open Innovation types used over the last 18 months	All	Non-IT	IT
Collaboration	57.6%	57.9%	57.1%
Customer Immersion	29.4%	26.3%	35.7%
Platforming	23.5%	21.1%	28.6%
Idea Competitions/Challenges	22.4%	22.8%	21.4%
Innovation Networks	22.4%	21.1%	25.0%
Lead Users	16.5%	8.8%	32.1%
IP or Tech Out-licensing or Selling	14.1%	12.3%	17.9%
Innovation Intermediaries	12.9%	12.3%	14.3%
IP or Tech In-licensing or Acquisition	5.9%	7.0%	3.6%

Collaboration was also considered by SMEs to be the most likely method they would follow in the coming 18 months. There were, however, mixed responses about which methods other than Collaboration would be followed as can be seen in the next tables for Non-IT and IT responses respectively.

TABLE A- 9: OPEN INNOVATION TYPES NEXT 18 MONTHS (NON-IT)

Open Innovation types to be used over the next 18 months (Non-IT)	Highly unlikely	Unlikely	Likely	Very likely
Collaboration	6%	13%	38%	42%
Idea Competitions/Challenges	28%	23%	23%	26%
Customer Immersion	10%	16%	51%	24%
Platforming	29%	13%	35%	23%

Open Innovation types to be used over the next 18 months (Non-IT)	Highly unlikely	Unlikely	Likely	Very likely
Innovation Networks	20%	18%	43%	18%
Lead Users	26%	26%	33%	15%
IP or Tech Out-licensing or Selling	32%	32%	23%	14%
Innovation Intermediaries	31%	26%	33%	10%
IP or Tech In-licensing or Acquisition	36%	36%	25%	2%

TABLE A- 10: OPEN INNOVATION TYPES NEXT 18 MONTHS (IT)

Open Innovation types to be used over the next 18 months (IT)	Highly unlikely	Unlikely	Likely	Very likely
Collaboration	4%	15%	27%	54%
Customer Immersion	13%	4%	48%	35%
Lead Users	14%	14%	33%	38%
Platforming	9%	9%	55%	27%
Idea Competitions/Challenges	9%	32%	32%	27%
Innovation Networks	8%	25%	42%	25%
IP or Tech Out-licensing or Selling	32%	27%	18%	23%
Innovation Intermediaries	20%	40%	25%	15%
IP or Tech In-licensing or Acquisition	40%	30%	20%	10%

To obtain a single score per preferred innovation approach a weighted score (-1, 1, 5, 9 from highly unlikely to highly likely) was assigned to each answer option and then each percentage was multiplied by the weighted score. The scores per row were then added together, resulting in a single score. This provided a preference ranking based on the survey results. The next table shows the results from highest to lowest preference after applying the weighted scores.

It shows that IP in- and out-licensing are not heavily preferred by South African SMEs. Making use of Intermediaries is also not a practice that SMEs rely on within their open innovation efforts.

TABLE A- 11: PREFERRED OPEN INNOVATIN TYPES

Preferred Open Innovation Types (overall)	Weighted Score
Collaboration	5.97
Customer Immersion	4.95
Platforming	4.14
Innovation Networks	4.03
Idea Competitions/Challenges	3.70
Lead Users	3.66
Innovation Intermediaries	2.58
IP or Tech Out-licensing or Selling	2.55
IP or Tech In-licensing or Acquisition	1.56

Participants were asked who they would consider as an ideal innovation partner to develop new innovations with. Customers came out as clear favourites, but the other partner options had mixed responses. As with the open innovation types, the results were processed with weighted scores to determine the preferred partners overall.

TABLE A- 12: PREFERRED OPEN INNOVATION PARTNERS (NON-IT)

Ideal collaboration partner to develop new innovations with (Non-IT)	Highly unlikely	Unlikely	Likely	Very likely
Customers	2%	10%	36%	52%
Suppliers	4%	18%	43%	35%
Universities and other academic institutions	17%	17%	42%	25%
Consultants	15%	15%	46%	23%
Non-competitor companies	11%	26%	45%	19%
Government development agencies	30%	37%	20%	13%
Technology transfer offices	20%	37%	30%	13%
Competitor companies	23%	34%	36%	6%

Customers and Suppliers were considered to be the preferred innovation partners, with Government agencies being the least preferred.

TABLE A- 13: PREFERRED OPEN INNOVATION PARTNERS (IT)

Ideal collaboration partner to develop new innovations with (IT)	Highly unlikely	Unlikely	Likely	Very likely
Customers	0%	8%	38%	54%
Universities and other academic institutions	12%	31%	23%	35%
Consultants	12%	15%	42%	31%
Suppliers	4%	13%	54%	29%
Non-competitor companies	13%	29%	46%	13%
Technology transfer offices	28%	40%	24%	8%
Competitor companies	24%	43%	24%	10%
Government development agencies	57%	30%	9%	4%

TABLE A- 14: PREFERRED OPEN INNOVATION PARTNERS (OVERALL)

Preferred Open Innovation Partners (overall)	Weighted Score
Customers	6.66
Suppliers	5.41
Consultants	4.56
Universities and other academic institutions	4.38
Non-competitor companies	3.93
Technology transfer offices	2.58
Competitor companies	2.41
Government development agencies	1.67

Looking at whether the participants thought that open innovation is an effective innovation model, the responses were shown to be very positive. More than 80 percent of the Non-IT organisations and more than 64 percent of the IT organisations agreed to this to some extent.

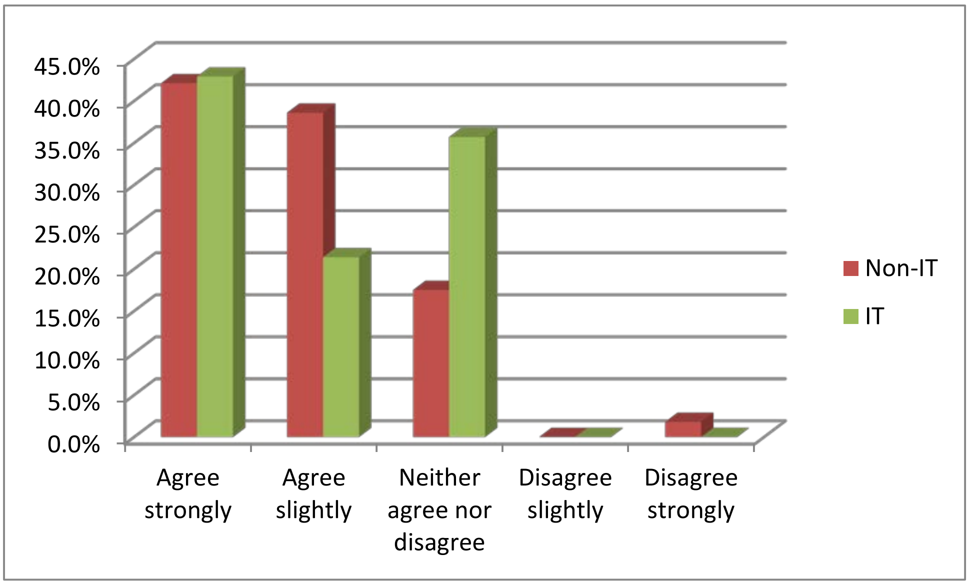


FIGURE A-11: OPEN INNOVATION AS AN EFFECTIVE INNOVATION MODEL

Asking participants if they thought open innovation was a viable innovation method for their organisations received a similar result to that of the previous question. They were mostly positive about the idea. This might have been expected, considering the high percentage of respondents who said that they are either in the process of open innovation roll-out or optimisation. It is even more encouraging, considering the close to 40 percent who indicated that they were not currently involved in any open innovation activity.

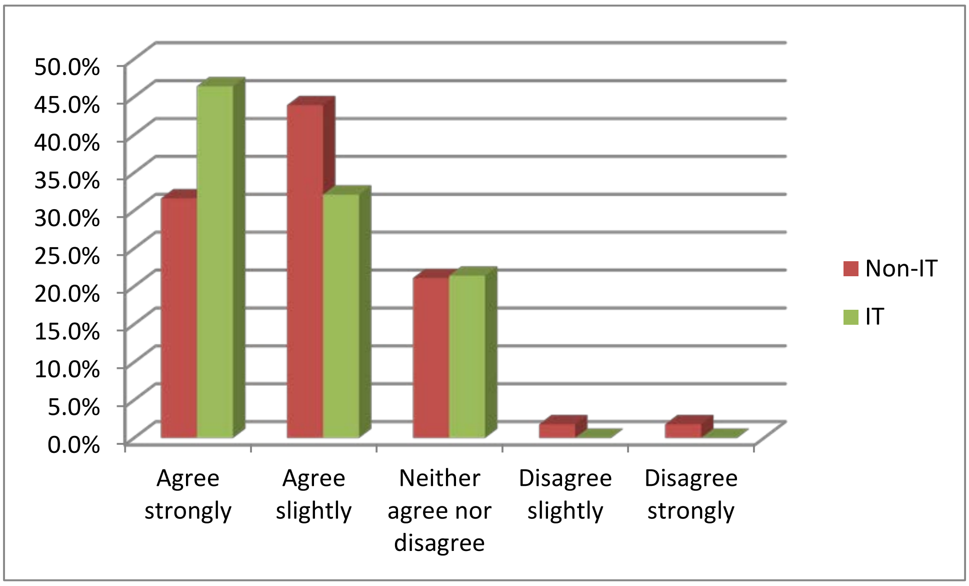


FIGURE A-12: OPEN INNOVATION AS A VIABLE INNOVATION METHOD FOR ORGANISATION

Participants were provided with the following barriers to using open innovation and then asked to select their top three barriers.

Finance: Obtaining financial resources.

Resources: Costs of innovation, time needed, human resources needed.

Organisation/culture: Balancing innovation and daily tasks, communication problems, aligning partners, organisation of innovation.

Knowledge: Lack of technological knowledge, lack of competent personnel, lack of legal/administrative knowledge.

Marketing: Insufficient market intelligence, market affinity, marketing problems with new products.

Administration: Bureaucracy, administrative burdens, conflicting rules.

Quality of partners: Partner does not meet expectations, deadlines are not met.

Idea management: Employees have too many ideas, no management support, no formal process for innovation.

Commitment: Lack of employee commitment, resistance to change.

Customer demand: Customer demand too specific, innovation appears not to fit the market.

Intellectual property rights: Ownership of developed innovations, user rights when different parties cooperate.

User acceptance: Adoption problems, customer requirements misjudged.

Competent employees: Employees lack knowledge/competences, not enough labour flexibility.

Finance and Resources were selected as the biggest barriers to using open innovation. Non-IT organisations marked Knowledge as their third-highest barrier, with IT organisations selecting Organisation/Culture to be a significant barrier.

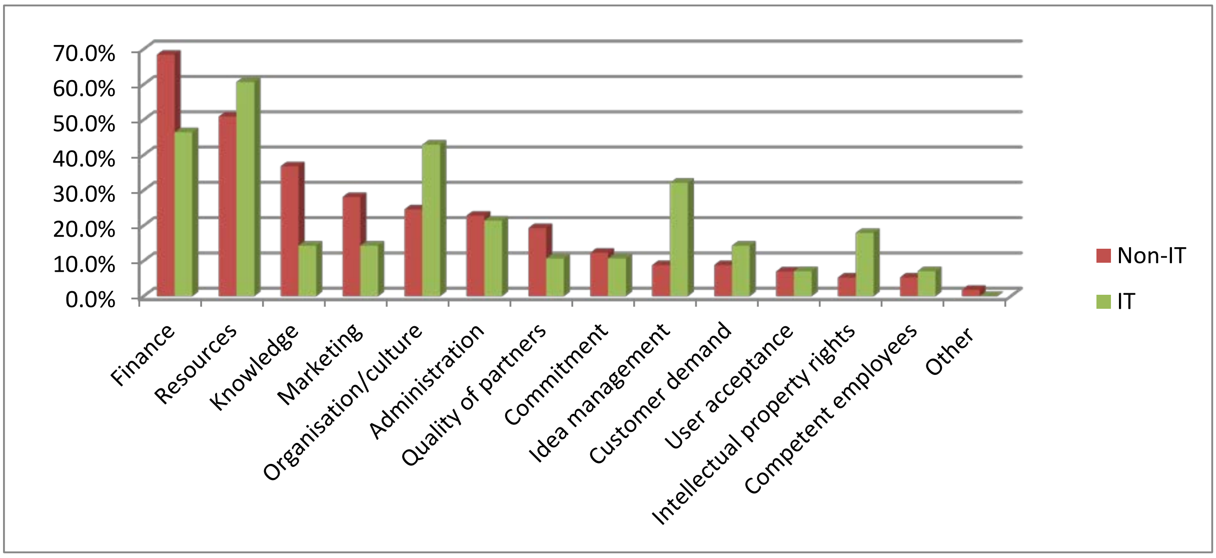


FIGURE A-13: BARRIERS TO OPEN INNOVATION

The above question was taken from an open innovation research study of Dutch SMEs (Van de Vrande et al., 2008). That study indicated Organisation/Culture as the main barrier and Administration as the second-highest barrier. It is interesting to note that intellectual property rights (IP) were not rated as a significant barrier by the South African SMEs, although this area receives a lot of attention in literature as a barrier to open innovation adoption.

When asked to rate their use of open innovation compared to other organisations in their industry, respondents typically rated it to be higher or the same as industry average, with only around 15 percent of respondents rating themselves below industry average. There seems therefore to be an element of self-bias in their innovation maturity and capability assessments.

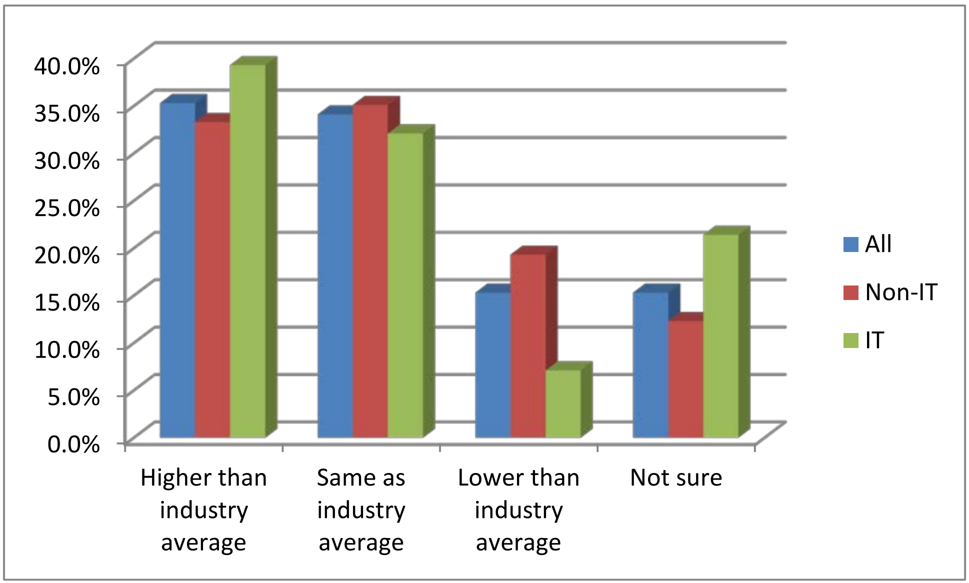


FIGURE A-14: OPEN INNOVATION USE COMPARED TO OTHER COMPANIES IN INDUSTRY

When asked if the understanding of open innovation in their organisations was sufficient to pursue open innovation initiatives without assistance, almost 30 percent of respondents disagreed, with another 30 percent answering neutrally to the question. So although a large percentage of respondents indicated that their organisations are embarking on open innovation, they also indicated that they were not all that confident in doing so on their own.

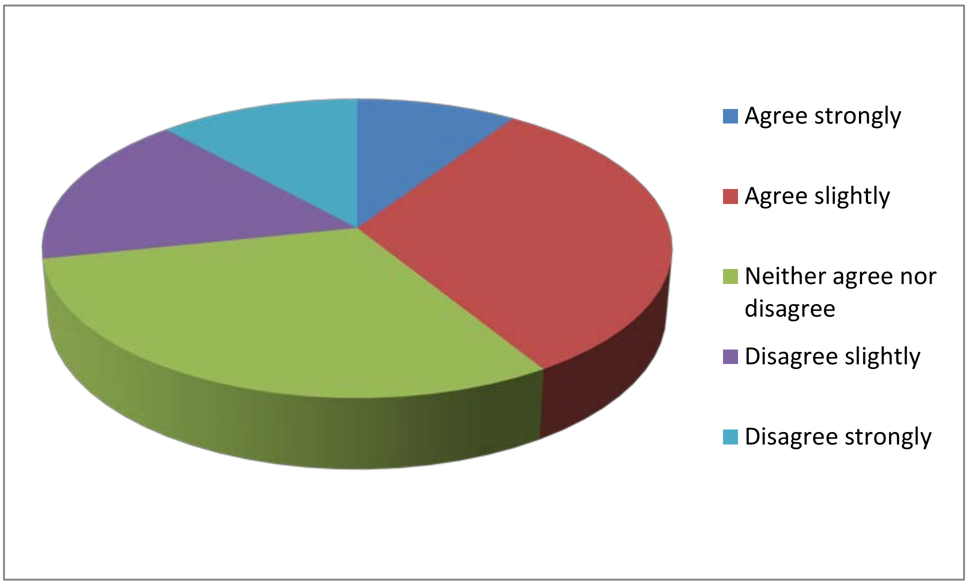


FIGURE A-15: CONFIDENT TO PURSUE OPEN INNOVATION WITHOUT ASSISTANCE

Appendix B OIL Framework Update

Developing the design propositions, which contain more detail than the OIL Framework on its own, resulted in the OIL Framework having to be refined. The detailed systematic review tested some of the previous assumptions of the framework and resulted in a more streamlined and robust framework for application. The original framework as developed in chapter 6 is shown below.

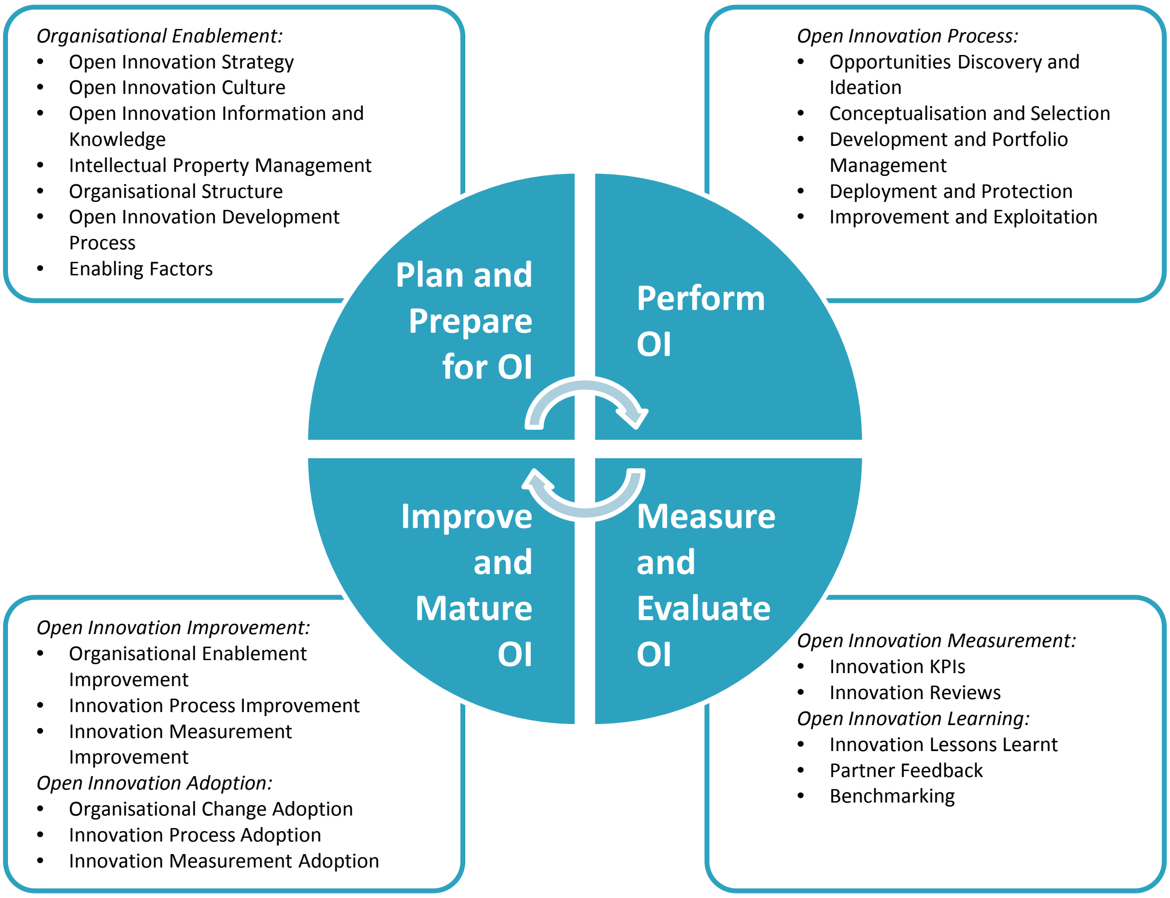


FIGURE B- 1: OIL FRAMEWORK V1

The following changes were made during the design proposition definition process:

Improvement and Exploitation: To stay consistent with previous definitions in literature, the heading for this section of the framework was adjusted from “Improvement and Exploitation” to “Exploitation and Exploration” emphasising the search for further value both closely related and further removed from the current innovation.

Open Innovation Measurement: The OIL Framework originally proposed a structure under 'Measure and Evaluate OI' to include Open Innovation Measurement and Open Innovation Learning as two separate subcomponents. Expanding on the concepts in this section, the author would suggest that it would make more sense to combine these two subcomponents into one, since they are interrelated. The Core elements originally described under the framework are also more appropriate under a combined heading, with some of the elements being tools and techniques to be used, rather than element categories – such as benchmarking for instance. This therefore leads to a revision of the framework with the subcomponent being described as Open Innovation Measurement (single subcomponent) and the elements being changed and reduced to

- Innovation KPIs and
- Innovation Reviews and Learning

Open Improvement Adoption: The OIL Framework distinguished between the sub-elements of Improvement and Adoption and further into the core elements contained therein, stating the three sub-elements of Organisational Enablement, Open Innovation Process and Open Innovation Measurement and Learning every time. For simplification and aligning to the user requirement of making the framework user-friendly, it is suggested that the two sub-elements be changed to a single sub-element of *Open Innovation Improvement*, thereby also creating consistency with only one sub-element for each main element in the OIL Framework. The core elements can then also be restated as follows for clarity – Organisation, Process, Measurement.

The revised framework (OIL Framework V2) is therefore shown below.

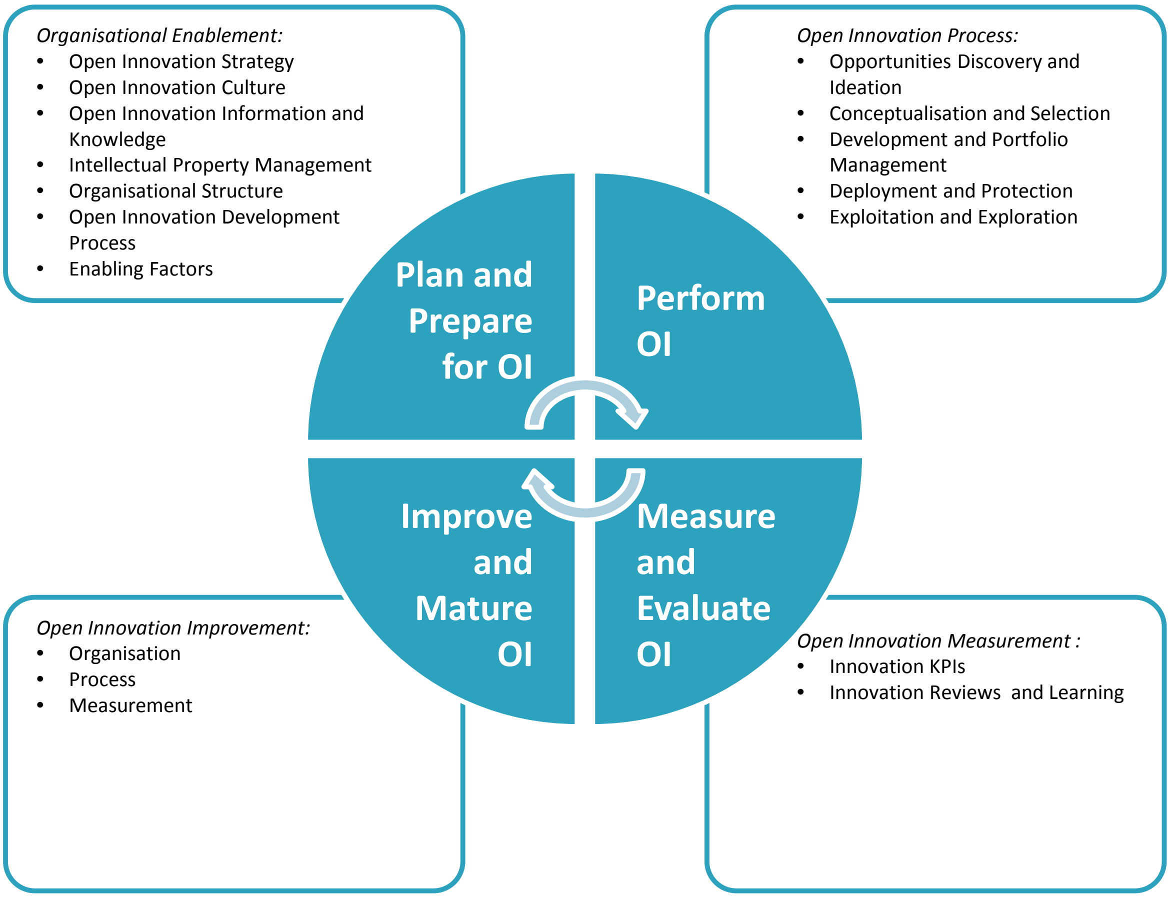


FIGURE B- 2: OIL FRAMEWORK V2

Appendix C Validation Surveys

C.1 Open Innovation Approach Review

Survey Results 1

Information about yourself

Name and Surname: Melanie Sutton

Country: South Africa

Profession: Knowledge Capital Consultant in Intangible Capital Innovation (Pty) Ltd t/a i-innovate. A knowledge capital consultancy focusing on identifying, leveraging and measuring the value of knowledge assets in small to medium-sized businesses in South Africa.

Employees: 3

Years in business: 3.5

Which best describes your involvement in Open Innovation (can have more than 1 answer):

Practitioner	User	Academic	Advisor
	x		

Years involved in Open Innovation:

Less than 3 years	3 to 6 years	More than 7 years
x		

Involvement focus (can have more than 1 answer):

Strategy	Implementation	Execution
x	x	x

Organisational focus and/or experience (can have more than 1 answer):

SME	Large organisations
x	

Would you prefer that we keep your identity anonymous in the study or can we disclose your identity if deemed needed?

SME	Large organisations
Happy with disclosure	

1. Design Propositions and Approach
   1.1. Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?

Agree	Slightly Agree	Slightly Disagree	Disagree
	x		

Comments: I feel that the approach is comprehensive, but I am reticent to agree that an SME will be able to implement this on their own the first time – especially if they are new to the whole concept of open innovation

   1.2. Which additional ones (or additional elements) would you propose?

Comments:

   1.3. Are the design propositions logical? Do they make sense and can they be followed?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

   1.4. Do you consider the approach to be user-friendly – i.e. easy to adopt, understandable, and easy to use?

Agree	Slightly Agree	Slightly Disagree	Disagree
	x		

Comments:

   1.5. Is the user allowed sufficient flexibility to apply their own discretion when using the approach?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

1.6. Does the approach consider the context of the user?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

1.7. Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

1.8. Does the approach support repeated and continued use?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments: This is an approach that an SME can become comfortable and familiar with and use as a strategic tool

1.9. Does the approach provide clear definitions and explanations?

Agree	Slightly Agree	Slightly Disagree	Disagree
	x		

Comments: Suggest compiling a glossary of terms for quick reference for the newly initiated into the open innovation space

1.10. Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments: I think this is a particularly strong aspect of this approach

2. Templates

2.1. Are the templates user-friendly?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

2.2. Are the templates understandable?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

2.3. Do the templates aid in the use of the approach?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

The templates serve a couple of purposes:

a) Pulls the approach together into a practical application
b) Allays the fear of where to start – what are my first next steps
c) Transparent and practical making it encouraging the SME to use the framework

2.4. Is the structure / layout of the templates appropriate?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

2.5. Are there gaps in the templates which you feel should be addressed / expanded on?

Comments: No

3. References

3.1. Do you think that sufficient references are included, on which the approach is based?

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments: The bibliography provides sufficient guidance if you a user wants to explore further on their own

3.2. Are there references with different views which you feel should have been considered?

Agree	Slightly Agree	Slightly Disagree	Disagree

Comments: Unable to comment on this question

Do you consider the design propositions and approach as reflective of current best practice in the evolving field of open innovation?

Agree	Slightly Agree	Slightly Disagree	Disagree

Comments: Unable to answer this question – I am not particularly au fait with the open innovation domain

4. General

4.1. Do you think that applying the approach will increase an organisation's chances of achieving success in Open Innovation compared to not following the approach at all?

Agree	Slightly Agree	Slightly Disagree	Disagree
	x		

Comments: As mentioned above, the approach enables the user to gain a landscape view of the open innovation opportunity (or an area within strategic capital as we Knowledge Capitalists like to frame innovation). The approach allows for customisation by the user, so there are no fundamental constraints that will prevent the user from making it their own. I definitely think that the approach offers SMEs more of an opportunity to achieve success than not having any approach at all.

I am however not in a position to comment on whether following this particular approach is superior to following other existing approaches (if any).

4.2. Are there any other remarks you would like to make regarding the Open Innovation approach?

Comments: What I particularly liked about the approach is the relationship that it has with the knowledge capital framework. The KCF seeks to identify knowledge assets across the organisation, put a value to them and then leverages those for success, particularly in achieving the strategic goals of the organisation. Innovation as a whole can be identified as a strategic goal.

This approach is particularly refreshing as it seeks to extend the relationship capital of an SME, inviting clients, partners, and vendors etc to participate in the innovation process and creating additional value for the knowledge assets of the organisation. This plays into the business model of the SME and can provide an entirely new income stream for the organisation.

I feel that this approach opens up new avenues for SMEs who are on various levels to participate, experiment and grow their business while still having to deliver business as usual.

I am excited to learn more about open innovation and look forward to some benchmarking in the future.

5. Finally, please rate the approach (design propositions and templates) overall in terms of being

5.1. Usable

Agree	Slightly Agree	Slightly Disagree	Disagree
	x		

Comments: Perhaps a suggestion for the future is a dashboard template that gives the user a high level overview of their particular information

5.2. Comprehensive

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

5.3. Understandable

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments:

5.4. Appealing

Agree	Slightly Agree	Slightly Disagree	Disagree
x			

Comments: This is a very exciting piece of work – as an SME, it offers a practical way to participate in open innovation

Survey Results 2

#1 COMPLETE

Completion Date: 10 July 2016

Information about yourself

Q2: Title:	Dr
Q3: Name and Surname:	Heinz Essmann
Q4: Country:	South Africa
Q5: Profession:	Consultant / Engineer
Q6: Industry	Consumer Products
Q7: Which best describes your involvement in Open Innovation (can have more than 1 answer): Other (please specify)	More involved in innovation in large organisations; sometimes utilising open tools
Q8: Years involved in Open Innovation or Open Innovation activities:	7 or more years
Q9: Involvement focus (can have more than 1 answer):	Implementation, Strategy
Q10: Organisational focus and/or experience (can have more than 1 answer):	SME, Large organisations
Q11: Would you prefer that we keep your identity anonymous in the study (not using your name) or can we disclose your identity if deemed needed?	Can disclose

Design Propositions and Approach

Q12: Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?	Agree, Supporting Comments: Design propositions cover a broad range of considerations. No model is complete in all circumstances, but this model should add value to most, if not all, SMEs looking to practice Open Innovation.
Q13: Which additional ones (or additional elements) would you propose?	Respondent skipped this question
Q14: Are the design propositions logical? Do they make sense and can they be followed?	Agree, Supporting Comments: The metamodel behind the DPs follows classic design/change thinking; this cannot be faulted.
Q15: Do you consider the approach to be user-friendly i.e., easy to adopt, understandable, and easy to use?	Slightly Agree, Supporting Comments: One addition, not necessarily vital in the completion of a PhD, but certainly valuable to any person or team looking to understand and utilise any of the DPs would be to provide actual examples of completed DPs from a 'real world' example.
Q16: Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	Agree
Q17: Does the approach consider the context of the user?	Slightly Disagree, Supporting Comments: I believe this a tough ask of any generic model. Again, a couple of examples could provide contextual alignment. Or, facilitated use of the DPs and the surrounding approach, could do this.
Q18: Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?	Agree

Q19: Does the approach support repeated and continued use?	Agree
Q20: Does the approach provide clear definitions and explanations?	Slightly Agree, Supporting Comments: The templates could be embellished with short definitions of new or specific terminology for quick reference (i.e. summaries, definitions from the detailed explanation) rather than paging between.
Q21: Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	Agree

Templates

Q22: Are the templates user-friendly?	Agree
Q23: Are the templates understandable?	Slightly Agree, Supporting Comments: See previous comments on examples and definitions.
Q24: Do the templates aid in the use of the approach?	Agree
Q25: Is the structure / layout of the templates appropriate?	Supporting Comments: See previous comments on examples and definitions. A spreadsheet with links, app or webpage could provide for a more interactive environment. (Again, this not for academic purposes! Only relevant to a practical application.)
Q26: Are there gaps in the templates which you feel should be addressed / expanded on?	See comments above.

References

Q27: Do you think that sufficient references are included, on which the approach is based?	Agree
Q28: Are there references with different views which you feel should have been considered?	Slightly Disagree, Supporting Comments: There are always different views; but not that I feel MUST be included.
Q29: Do you consider the design propositions and approach as reflective of current best practice in the evolving field of Open Innovation?	Agree

General

Q30: Do you think that applying the approach will increase an organisation's chances on achieving success in Open Innovation compared to not following the approach at all?	Slightly Agree, Supporting Comments: I think that models help. But, they cannot replace Human Capital; a significant deficiency in this area will not be plugged by any model. But a good model can make a good team better. I believe this this mode will help.
Q31: Are there any other remarks you would like to make this regarding the Open Innovation approach?	Respondent skipped question

Final questions

Q32: Usable	Slightly Agree
Q33: Comprehensive	Agree
Q34: Understandable	Agree
Q35: Appealing	Slightly Agree

Survey Results 3

#2 COMPLETE

Completion Date: 14 July 2016

Information about yourself

Q2: Title:	Mr
Q3: Name and Surname:	Izak Coetzer
Q4: Country:	South Africa
Q5: Profession:	Team building and youth camps facilitator
Q6: Industry	Service
Q7: Which best describes your involvement in Open Innovation (can have more than 1 answer): Other (please specify)	User (make use of Open Innovation in the organisation)
Q8: Years involved in Open Innovation or Open Innovation activities:	Less than 3 years
Q9: Involvement focus (can have more than 1 answer):	Execution
Q10: Organisational focus and/or experience (can have more than 1 answer):	SME
Q11: Would you prefer that we keep your identity anonymous in the study (not using your name) or can we disclose your identity if deemed needed?	Can disclose

Design Propositions and Approach

Q12: Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?	Agree
Q13: Which additional ones (or additional elements) would you propose?	n/a
Q14: Are the design propositions logical? Do they make sense and can they be followed?	Agree, Supporting Comments:

	It was written and explained very thoroughly, very easy to follow.
Q15: Do you consider the approach to be user-friendly i.e., easy to adopt, understandable, and easy to use?	Agree
Q16: Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	Agree
Q17: Does the approach consider the context of the user?	Agree
Q18: Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?	Agree
Q19: Does the approach support repeated and continued use?	Agree
Q20: Does the approach provide clear definitions and explanations?	Agree, Supporting Comments: very clear.
Q21: Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	Agree

Templates

Q22: Are the templates user-friendly?	Agree, Supporting Comments: the templates have been designed with an everyday 'Joe' in mind.
Q23: Are the templates understandable?	Agree
Q24: Do the templates aid in the use of the approach?	Agree
Q25: Is the structure / layout of the templates appropriate?	Agree
Q26: Are there gaps in the templates which you feel should be addressed / expanded on?	NO

References

Q27: Do you think that sufficient references are included, on which the approach is based?	Agree
Q28: Are there references with different views which you feel should have been considered?	Supporting Comments: Not applicable to my situation/organisation.
Q29: Do you consider the design propositions and approach as reflective of current best practice in the evolving field of Open Innovation?	Agree

General

Q30: Do you think that applying the approach will increase an organisation's chances on achieving success in Open Innovation compared to not following the approach at all?	Agree
Q31: Are there any other remarks you would like to make this regarding the Open Innovation approach?	n/a

Final questions

Q32: Usable	Agree, Supporting Comments: Any organisation will be able to run this system as it is currently, very simplistic but very insightful.
Q33: Comprehensive	Agree
Q34: Understandable	Agree
Q35: Appealing	Agree

Survey Results 4

#3 COMPLETE

Completion Date: 1 December 2016

Information about yourself

Q2: Title:	Dr
Q3: Name and Surname:	Anthon Botha
Q4: Country:	South Africa
Q5: Profession:	Technology, Innovation & Knowledge Management Consultant
Q6: Industry	Consulting
Q7: Which best describes your involvement in Open Innovation (can have more than 1 answer): Other (please specify)	Academic, Advisor / consultant
Q8: Years involved in Open Innovation or Open Innovation activities:	7 or more years
Q9: Involvement focus (can have more than 1 answer):	Strategy, Implementation
Q10: Organisational focus and/or experience (can have more than 1 answer):	SME
Q11: Would you prefer that we keep your identity anonymous in the study (not using your name) or can we disclose your identity if deemed needed?	Can disclose

Design Propositions and Approach

Q12: Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?	Agree, Supporting Comments: The design proposition focuses on SMEs. Yet, there is not a similar concept available for large organisations. Since most SMEs innovate (especially in OI) with large organisations, the concept has potential to be applied wider, also

	in large organisations and especially at the interface between organisations.
Q13: Which additional ones (or additional elements) would you propose?	The design propositions represent a very comprehensive collection of the relevant innovation issues in the application environments. As such it draws from a wide body of knowledge and integrates many aspects. The interrelationship among the elements of the design proposition may require some thought. In addition, an element of being able to assess the future environment may be useful.
Q14: Are the design propositions logical? Do they make sense and can they be followed?	Agree, Supporting Comments: A logical path through the design propositions is outlined. When first looking at them they seem overwhelming and may result in difficulty in implementation. A high level, simplified graphical model is required that will become the mental reference for a user. This graphical model could be used as a 'lens' to look at a specific OI initiative, binding the innovation partners together and guiding them. It could also be used as an interfacial [sic] tool between partners, especially when they represent SMEs and large entities that innovate together.
Q15: Do you consider the approach to be user-friendly i.e., easy to adopt, understandable, and easy to use?	Slightly Disagree, Supporting Comments: The vast number of issues addressed make the model, albeit a good theoretical one, slightly difficult to implement. There is also not enough information in the material provided to fully understand the way the templates will be used and what the holistic outcome will be. Some of the templates also need more detail, since all aspects leading to an understanding of the model and a guiding OI tool, are missing. The driving links among the different elements need to be reinforced and the focus on an outcome is required.

Q16: Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	Slightly Agree, Supporting Comments: From the information provided for the validation, it is not clear how customisation is allowed, although it is clearly stated that the model is flexible. It is not clear at present how the boundaries are defined and what the minimum approach would be to still get sufficient guidelines from the OI model. The templates, specifically, have major gaps in terms of guiding a user towards a unified adoption of the approach.
Q17: Does the approach consider the context of the user?	Slightly Agree, Supporting Comments: It does consider the context of the user in terms of size and internal capability to innovate. It is not obvious that it addresses the "conjunctural" context of the user. How does it support the OI team consisting of multiple partners? It may prepare individual OI partners, but it is not aimed at the collective where the innovation takes place.
Q18: Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?	Slightly Agree, Supporting Comments: The approach is filling a gap at present, since such a wide view of OI related issues does not exist. It can definitely be used as a management aid. The deficiencies related to preparing individual partners, and not the partnership as a whole have been pointed out in previous comments. It may require a small extension of the thinking, using the same concept to address that.
Q19: Does the approach support repeated and continued use?	Slightly Disagree, Supporting Comments: The templates are not extensive in addressing all aspects of the CIMO logic, but primarily focus on context and interaction. In many cases the mechanism and outcome are not addressed adequately. Especially the linkage of outcomes needs more attention. The

	templates provide guidelines, but not always space for capturing content that would be useful for repeated and continued use. Ideally, the approach should become a continuous selfassessment and set benchmarks. It should also provide a facility where good OI matches for different partners can be established.
Q20: Does the approach provide clear definitions and explanations?	Agree, Supporting Comments: The discussion of each of the levels of the approach, its reference to the existing body of knowledge and motivation for why it was extracted and made part of the approach was done in great detail and clarity. It is continuity between the different levels and how they influence each other that may need a bit more attention.
Q21: Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	Slightly Disagree, Supporting Comments: There are no obvious parameters that are industry specific and as such the approach is generic. It may, however, be this characteristic (generic) that may cause reluctance for adoption. The different industries look at innovation in different ways, partner differently and use their own maturity and capability level assessment. They also have their own sets of KPIs that have to be made compatible with OI KPIs. Again, the interface between SMEs and large enterprises cogenerating ideas and involved in OI need to be addressed carefully. It is suggested that the approach remain generic, with clear links to and recognition for existing approaches for measuring flexibility, capability, and maturity in different industries and disciplines.

Templates

Q22: Are the templates user-friendly?	Disagree, Supporting Comments:

	Although well-designed, clear to the extent of what it addresses, the templates are not complete. Too often emphasis is only placed on context and interaction and not on mechanism and outcome in the CIMO logic. There is not a feeling of flow through the elements of the approach. In some cases information may be collected, in others only assessment of the culture or approach in an organisation using the templates. The templates are also too isolated, one not feeding from the other and the feeling of fragmentation in decision-making is strong. The templates are a good way of assessing the readiness for OI, linked to the OIL Framework, but they do not lead to guidance on what to improve, how to approach and how to partner for specific OI initiatives. It is in essence not tied together into a reinforcing outcome.
Q23: Are the templates understandable?	Agree, Supporting Comments: The templates are well-designed and lead the user to extracting and supplying the right information. Apart from previous comments that not all aspects of the CIMO are addressed equally in all of them, they are stimulating in their design. Clear links to each aspect of the CIMO logic for each element of the approach may assist in a clearer understanding.
Q24: Do the templates aid in the use of the approach?	Supporting Comments: They do indeed, but it is not clear from the information supplied how they will be applied. Will the user first have to study the model (approach) and then use the templates to fill in their own situation? How do the templates then guide them to the right approach for OI in partnership with other players? The theory is well structured, the approach to do the self-evaluation and gather an understanding of OI readiness is sound, but the way the outcomes should be applied is still unclear.
Q25: Is the structure / layout of the templates appropriate?	Slightly Agree, Supporting Comments:

	As said before, some are better than others. In many cases information gathering to complete the CIMO logic are absent. They should be revised with a clear link of each element where information is gathered to a CIMO component.
Q26: Are there gaps in the templates which you feel should be addressed / expanded on?	Yes, these refer to comments made above. They have been marked on the individual templates and will be communicated in an interview.

References

Q27: Do you think that sufficient references are included, on which the approach is based?	Agree, Supporting Comments: A very substantive reference list is provided
Q28: Are there references with different views which you feel should have been considered?	Disagree, Supporting Comments: The references address a diverse spread of views that were combined into the new approach and are adequate.
Q29: Do you consider the design propositions and approach as reflective of current best practice in the evolving field of Open Innovation?	Agree, Supporting Comments: The approach is comprehensive and addresses some fragmentation and gaps in OI practice. It provides a holistic view of many individual aspects that are addressed in context of OI. Therefore the importance of ensuring a confluence of the elements that point to a clear and implementable OI approach.

General

Q30: Do you think that applying the approach will increase an organisation's chances on achieving success in Open Innovation compared to not following the approach at all?	Slightly Agree, Supporting Comments: If one organisation uses the approach and another not and they get together in an OI partnership, there may be an unbalance in

	working together. Therefore the approach must consider to assist a team that embarks on OI rater than individual partners. In this context it should apply to SMEs and large enterprises alike.
Q31: Are there any other remarks you would like to make this regarding the Open Innovation approach?	The approach represents an innovation in itself - it takes existing concepts and combines them in such a way that they have new value to the user. The question is how much new knowledge is added for a PhD? There are suggestions in the design propositions document for adding to the knowledge gained from the literature, but an attempt should be made to take this conceptual model and approach to support OI and see if original knowledge can be added over and beyond the collation of the elements that are supported by the knowledge base that exists.

Final questions

Q32: Usable	Agree, Supporting Comments: See earlier comments on how the usability can be improved, e.g. extending it to include large enterprises, simplify the model in a graphic representation, ensure that a clear link between template elements and the model exist and generate a clear outcomes view. Also pay attention to a clear integration between the OIL Framework and the model.
Q33: Comprehensive	Slightly Agree, Supporting Comments: The model could be more comprehensive if it is not only aimed at SMEs but also include larger enterprises, assist with the interface between or among partners and is applied to the partnership as a whole as well as the individual participants.
Q34: Understandable	Slightly Agree,

	Supporting Comments: This response relates more to the material provided and the linkages between the description of the approach and the templates. A gap in description exists in how the templates are to be used. It is also not clear from the material provided whether the thesis will address an experimental round of applying the model in practice and learning from that or whether it is only a conceptual and theoretical approach.
Q35: Appealing	Supporting Comments: The model can be made more appealing by using more visualisation to support a thought or mind model, in addition to the very complete write-up provided. There should be a visualisation of the model, its position and role in an OI initiative, its links to the templates and its link to the OIL Framework, as well as, and very importantly, the expected outcomes for the OI partners. The templates have the right level of visualisation, but should be revised to address all aspects of the CIMO logic.

Survey Results 5

#4 COMPLETE

Completion Date: 15 December 2016

Information about yourself

Q2: Title:	Mr
Q3: Name and Surname:	VDS Brink
Q4: Country:	South Africa
Q5: Profession:	Consulting, lecturing, writing
Q6: Industry	Consulting

Q7: Which best describes your involvement in Open Innovation (can have more than 1 answer): Other (please specify)	Advisor / consultant, Academic
Q8: Years involved in Open Innovation or Open Innovation activities:	7 or more years
Q9: Involvement focus (can have more than 1 answer):	Implementation, Strategy
Q10: Organisational focus and/or experience (can have more than 1 answer):	Large organisations, SME
Q11: Would you prefer that we keep your identity anonymous in the study (not using your name) or can we disclose your identity if deemed needed?	Can disclose

Design Propositions and Approach

Q12: Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?	Agree, Supporting Comments: After working with dozens of SMEs and large organizations, the theory makes great sense
Q13: Which additional ones (or additional elements) would you propose?	Respondent skipped this question
Q14: Are the design propositions logical? Do they make sense and can they be followed?	Agree
Q15: Do you consider the approach to be user-friendly i.e., easy to adopt, understandable, and easy to use?	Slightly Agree, Supporting Comments: It is somewhat complex to follow, yet anything can be simplified if needed.
Q16: Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	Agree
Q17: Does the approach consider the context of the user?	Slightly Agree, Supporting Comments: See comment above about complexity

Q18: Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?	Agree, Supporting Comments: In SMEs the focus is on production and marketing losing sight of the bigger picture and those small things that can make a big difference.
Q19: Does the approach support repeated and continued use?	Agree
Q20: Does the approach provide clear definitions and explanations?	Agree, Supporting Comments: See above about complexity. More pictures and diagrams with less words to be a next step.
Q21: Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	Agree, Supporting Comments: Working with factories, IT, education ... same thing and applicable.

Templates

Q22: Are the templates user-friendly?	Agree
Q23: Are the templates understandable?	Agree
Q24: Do the templates aid in the use of the approach?	Agree, Supporting Comments: More templates the better!
Q25: Is the structure / layout of the templates appropriate?	Agree
Q26: Are there gaps in the templates which you feel should be addressed / expanded on?	The total context is complex, a first few is that the templates serves its purpose perfectly.

References

Q27: Do you think that sufficient references are included, on which the approach is based?	Agree

Q28: Are there references with different views which you feel should have been considered?	Slightly Agree, Supporting Comments: Business is a people contact game. More references to work on psychology and sociology is critical to enlight change.
Q29: Do you consider the design propositions and approach as reflective of current best practice in the evolving field of Open Innovation?	Agree

General

Q30: Do you think that applying the approach will increase an organisation's chances on achieving success in Open Innovation compared to not following the approach at all?	Agree, Supporting Comments: Absolutely! Getting more structure in our innovative efforts make all the difference.
Q31: Are there any other remarks you would like to make this regarding the Open Innovation approach?	Respondent skipped this question

Final questions

Q32: Usable	Agree, Supporting Comments: I love it and plan to apply in the near future. Will keep you informed!
Q33: Comprehensive	Agree
Q34: Understandable	Slightly Agree, Supporting Comments: As stated earlier
Q35: Appealing	Agree

Survey Results 6

#5 COMPLETE

Completion Date: 4 April 2017

Information about yourself

Q2: Title:	
Q3: Name and Surname:	
Q4: Country:	Australia
Q5: Profession:	Program Manager
Q6: Industry	Entertainment & Recreation
Q7: Which best describes your involvement in Open Innovation (can have more than 1 answer): Other (please specify)	User (make use of Open Innovation in the organisation)
Q8: Years involved in Open Innovation or Open Innovation activities:	Less than 3 years
Q9: Involvement focus (can have more than 1 answer):	Execution, Implementation, Strategy
Q10: Organisational focus and/or experience (can have more than 1 answer):	SME
Q11: Would you prefer that we keep your identity anonymous in the study (not using your name) or can we disclose your identity if deemed needed?	Anonymous

Design Propositions and Approach

Q12: Are the design propositions comprehensive for the implementation, execution and improvement of Open Innovation in SMEs?	Agree
Q13: Which additional ones (or additional elements) would you propose?	Respondent skipped question
Q14: Are the design propositions logical? Do they make sense and can they be followed?	Agree

Q15: Do you consider the approach to be user-friendly i.e., easy to adopt, understandable, and easy to use?	Agree
Q16: Is the user allowed sufficient flexibility to apply their own discretion when using the approach?	Agree
Q17: Does the approach consider the context of the user?	Agree
Q18: Can the approach be considered as a management aid for implementing, executing and improving Open Innovation within SMEs?	Agree
Q19: Does the approach support repeated and continued use?	Agree
Q20: Does the approach provide clear definitions and explanations?	Agree
Q21: Do you feel that the approach is generic and flexible enough to be used by SMEs in different industries and at different levels of maturity and capability?	Agree

Templates

Q22: Are the templates user-friendly?	Agree
Q23: Are the templates understandable?	Agree
Q24: Do the templates aid in the use of the approach?	Agree
Q25: Is the structure / layout of the templates appropriate?	Agree
Q26: Are there gaps in the templates which you feel should be addressed / expanded on?	No

References

Q27: Do you think that sufficient references are included, on which the approach is based?	Agree

Q28: Are there references with different views which you feel should have been considered?	Agree
Q29: Do you consider the design propositions and approach as reflective of current best practice in the evolving field of Open Innovation?	Agree

General

Q30: Do you think that applying the approach will increase an organisation's chances on achieving success in Open Innovation compared to not following the approach at all?	Agree, Supporting Comments: The open innovation approach has provided a sustainable model for success.
Q31: Are there any other remarks you would like to make this regarding the Open Innovation approach?	Respondent skipped this question

Final questions

Q32: Usable	Agree, Supporting Comments: Easy to use tool for effective results
Q33: Comprehensive	Agree
Q34: Understandable	Agree
Q35: Appealing	Agree